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COVER PICTURE

Red flowering gum on the road to Rockingham (near Spearwood)

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INCUBATION

By R. VAGG, Poultry Instructor

THE artificial incubation of eggs is not a recent innovation. For many centuries, some species of birds—our mallee-hen being a typical example—have hatched out their eggs by the heat generated in mounds of decaying vegetation. Furthermore, they have shown considerable skill in maintaining the mounds at uniform temperatures throughout the hatching period. A number of reptiles employ similar methods to hatch their eggs, although in these instances there does not seem to be the same need for carefully-controlled temperatures.

Even man is not exactly a beginner in the art of artificially incubating the eggs of the domestic fowl. Thousands of years ago he achieved some success in augmenting the efforts of the broody hens by placing eggs in baskets and maintaining them at a constant and uniform temperature by various ingenious devices.

Later, with increases in world population and the development of poultry-farming into an important primary industry, many types of specially designed incubators were invented and manufactured until today we have a wide variety of models ranging from small 50-egg cabinets to huge machines capable of hatching many thousands of eggs simultaneously.

Although these modern machines embody many ingenious ideas such as automatic temperature controls and methods of regulating humidity and ventilation, their successful operation depends upon an understanding of certain basic principles of incubation. Individual machines —even of identical makes and models— have their own peculiarities, appreciation of which only comes with experience. Even a thorough knowledge of the incubator and the principles of its operation are not sufficient in themselves to ensure maximum success.

We know today that much of the success or failure of a hatch is predetermined before the eggs are placed in the incubator—even before the eggs are laid.

A good hatchery. Note the clean appearance of the building . Gravel in the foreground is for customers' car park.

FEEDING IS IMPORTANT

The feeding of the parent birds plays an important part. Incorrect feeding, while it does not appear to affect fertility to any marked degree, can seriously reduce the hatchability of the eggs and can affect the subsequent well-being of the chickens which do hatch out.

Research work carried out in many countries throughout the world has provided us with important information on foods and feeding. We are learning more concerning the importance of vitamins— substances which are present in natural foods and exercise an influence upon nutrition which appears to be out of all proportion to the amounts consumed.

Where animals or birds are feeding under natural conditions with a wide

range of foodstuffs available, they can usually obtain all the vitamins they need. Under domesticated conditions where the range of foodstuffs is limited, they are liable to suffer from vitamin deficiencies unless *special* care is taken to include vitamin-rich preparations in the rations.

There are a number of vitamins known to science, but some of the most important to the hatcheryman are vitamins A, B_2, D and E. Vitamin A is normally supplied in good succulent greenfeed, but because adequate supplies of suitable greenfeed are not always available when needed, the poultry-raiser would be well advised to augment the greenfeed supplies with a vitamin A supplement.

These supplements are usually prepared from fish-liver oils—a rich source of vitamin A, and an intake of 4,720 international units of this vitamin per 1 lb. of food is regarded as the necessary level for breeding hens.

Experiments have shown that where breeding hens were fed on rations deficient in vitamin A, the survival rate of chicks —hatched from their eggs and fed on a ration that was purposely deficient in vitamin A—was in direct proportion to the degree of deficiency in the hen's rations. This indicates that where the parent birds receive adequate supplies of this vitamin the chicks receive the benefit and are given a good start in life.

Vitamin B_2 riboflavin is present in yeast, young greenfeed, milk powder, liver, egg-yolk, lucerne meal, etc., and is a particularly important ingredient of poultry rations. A deficiency of this vitamin causes paralysis in chicks, with a tendency to walk on the hocks, followed ultimately by a curling of the toes. It also results in lowered egg production, increased embryonic mortality and an increase in the size and fat content of the birds' livers.

Before the advent of synthetic riboflavin supplements poultrymen were limited in their choice of foodstuffs that were rich in riboflavin. Because of the high cost of such foods and because many breeders were unaware of the importance of vitamin B_2, many poor hatches were experienced. Today, synthetic riboflavin is widely used and, with the inclusion of natural sources of riboflavin in the diet of the breeding birds, excellent hatching results have been achieved.

Vitamin D deficiency is not normally a serious problem in this State as most of our breeding birds are exposed to direct sunlight which enables their bodies to synthesize ample supplies of this vitamin. Where birds are intensively housed, the sheds should be designed to admit direct sunlight and, as an added precaution, a vitamin D supplement should be added to the ration, This is particularly necessary during long periods of overcast weather. Vitamin D deficiency causes lowered production, decreased hatchability, weak-shelled eggs and heavy chick mortality. There is evidence to indicate that "sticky hatches" can be caused by vitamin D deficiency.

Vitamin E is necessary for good hatchability. Adequate supplies in the diet of the breeders will help to maintain the reproductive organs in good condition.

It is found in grains, lucerne meal, greenfeed and wheat germ. An insufficient supply can result in high embryonic mortality and heavy losses in young chicks.

Selection of eggs for hatching is of importance. The quality of eggs determines to an extent the kind of chicken that will be hatched. Eggs of sound shell and good texture are the only eggs that should be set. Egg size has a bearing on the size of the chick hatched as there is a correlation between egg size and chick size. Average sized eggs also hatch better than small or large eggs. (In this State the egg set usually weighs two ounces.)

The practice of discarding underweight eggs is a crude method of egg size control. Removal from the flock of the birds laying undesirable size eggs is the logical method of egg size control.

VENTILATION

Many practical hatcherymen do not pay sufficient attention to this very important part of incubation and a few explanatory notes may prove of assistance.

The ventilation of a machine is controlled by inlet and outlet vents the use of which differ in individual makes of incubators and therefore it is important to follow the makers' recommendations until the operator is well aware of the required procedure of the machine concerned.

There is a connection between moisture and ventilation for instance; if the humidity is high the moisture trays can be removed or if no moisture trays are being used humidity can be lowered by opening the ventilators. Both inlet and outlet ventilators should be opened a similar amount to ensure that enough oxygen is replacing the forced out stale air.

As an egg is incubated the amount of carbon dioxide gas produced by the embryo increases by approximately 40 times and this waste gas is eliminated through the shell membrane and shell as incubation proceeds. Naturally oxygen requirements increase and the importance of replacing spent oxygen cannot be over emphasised. For normal embryonic development the surrounding atmosphere should contain from 0.4 to 0.6 per cent. carbon dioxide. If the carbon dioxide content is one per cent. then hatchability is greatly reduced and at two per cent. there is no chance of the embryo surviving. If the carbon dioxide produced by the embryo cannot escape the embryo dies from an accumulation of CO_2 in the blood-stream.

An interesting example is the extent of exchange of gases during incubation of 1,000 eggs for the whole period of 21 days. These eggs will take up 290 cu. ft. of oxygen and give off 150 cu. ft. of carbon dioxide.

During a power failure it is generally thought that chicks in the process of incubation are killed by a concentration of heat at the top of the incubator, and a lack of heat on the lower trays; this however is not so. Whilst the heat falls the production of carbon dioxide does not and the gas accumulates rapidly very often weakening the embryos or if the stoppage is for a long period killing them.

It is therefore important to keep the fans operating by some mechanical process during a power breakdown. Another important step is to open the vents sufficiently to allow the CO_2 to escape. The best form of insurance is a power plant where electricity is available to keep both the fans turning and a constant supply of heat.

An important point is that an insufficient supply of oxygen will result in dead germs and malformed chicks.

TEMPERATURE

The optimum hatching results are obtained when the temperature is at 100° F., oxygen concentration 21 per cent., carbon dioxide concentration less than 0.5 per cent. and air movement past the eggs 12 c.m. per minute.

Incubator operators may, after some observations, find that a maximum hatching heat of 101° F. gives best results. This is probably due to a 1° variance in the thermostatic mechanism which controls maximum and minimum heat. That is if the minimum heat was 100° F. and the maximum heat 101° F. then the approximate average heat would be 100½° F.

Whilst this ½° F. extra heat may not seriously affect hatch results the maximum results are possibly not being obtained.

If the same machine was allowed a maximum heat of 100½° F. and a minimum of 99½° F. the optimum hatching heat of 100° F. would be obtained.

Different incubators have varying degrees of temperature error; if however, in any machine the variance is more than 1° F. corrective measures should be applied to the thermostatic temperature controls.

Temperatures greater than required give rise to an increased growth of the embryo and considerably increased liberation of carbon dioxide. Dead germs and abnormal chickens are bound to result if this high temperature incubation is practised.

Temperatures lower than required have an opposite effect. Early embryo mortality will occur and chicks will be slow to hatch.

The operator should have the incubator thermometers checked regularly to avoid error through faulty instruments.

HUMIDITY

In the incubation of eggs humidity plays a most important part and too much care cannot be given to this particular incubation phase.

It is possible to hatch chickens without the inclusion of any moisture save that introduced by the eggs themselves. In this case eggs are placed in the incubator, ventilators all closed in the setting compartment and the machine stays this way except for turning until the eighteenth

day when they are transferred to the hatching compartment. It can be seen that whilst this may provide sufficient moisture there is one element of danger in regard to the lack of oxygen.

Seasonal differences have an effect on the humidity present in the atmosphere and therefore exert an influence on the concentration of moisture in the incubator. It well may be that these atmospheric conditions provide sufficient humidity without the inclusion of additional moisture to the incubator and in such a case additional moisture would prove harmful.

A note of caution is that this is not usually the case although it does occur and is usually brought about by an insufficient flow of air throughout the incubator which of course is detrimental to hatching.

Relative humidity refers to the ratio between the actual amount of water vapour in the atmosphere and the amount of water the atmosphere is capable of holding.

As the temperature rises the atmosphere is capable of absorbing more moisture, therefore at 50° F. 1,000 cubic ft. of air is capable of holding 0.587 lb. of water, at 100° F. the same quantity of air can hold 2.857 lb. of water. If at 100° F. 1,000 cubic ft. of air is found to contain 1.800 lb. of water which is equal to 63.003 of its capacity the relative humidity is 63.003 per cent.

For the measurement of humidity a wet bulb thermometer and a dry bulb thermometer are used. The wet bulb thermometer is simply an ordinary thermometer which has a cotton wick enclosing the mercury bulb with the other end of the cotton wick immersed in water. The water travels along the wick and encases the mercury bulb. Air from the incubator fans passes over the wet bulb and a reading can be made on the column of the graduated thermometer.

It must be clearly understood that this reading is only a wet bulb reading and is not a relative humidity reading. This is obtained by calculations obtained from wet and dry bulb readings.

The following table contains readings obtained from the wet bulb thermometer and converted by this process to degrees of relative humidity.

In incubation there is a drying out process and the size of the air cell increases as incubation proceeds. This is of course necessary but too much drying out is harmful. The inclusion of water assists

RELATIVE HUMIDITY TABLE

Wet Bulb Thermometer Reading		Percentage of relative Humidity when Dry Bulb thermometer reading is at			
		98 Deg.	99 Deg.	100 Deg.	101 Deg.
Degrees		Per cent.	Per cent.	Per cent.	Per cent.
	94	86	83	80	77
	93	83	80	77	74
Matching Range	92	79	76	74	71
	91	76	73	71	68
	90	73	70	68	65
	89	70	67	65	63
	88	67	65	63	60
	87	65	62	60	57
	86	61	59	57	54
Setting Range	85	58	56	54	51
	84	55	53	51	49
	83	53	51	48	46
	82	50	48	46	44
	81	48	45	43	41
	80	45	43	41	39

in creating a moisture laden atmosphere and too rapid drying is prevented.

The amount of relative humidity is controlled by ventilation, as stated in the section Ventilation, and opening of the ventilators lowers the incubator humidity, as the outside air usually contains less moisture than that inside the machine.

To increase humidity close the ventilators as necessary but remember the necessity of air circulation.

It will be noticed that a setting range and hatching range has been suggested and until the operator is familiar with the workings of his incubator, hatching within these ranges will prove satisfactory. Another type of humidity gauge is the hygrometer. This instrument works on the principle that a certain length of catgut or hair contracts or lengthens respectively when it becomes wet. As the material used becomes dry or wet the decrease or increase of length is magnified by a suitable mechanism which moves a pointer giving a reading of relative humidity direct.

This instrument besides being costly, is not reliable and needs constant recalibration.

Eggs from the lighter breeds such as White Leghorns seem to require a lower

humidity than eggs from heavier breeds and it is suggested that a wet bulb reading of 80° in the setting compartment and 90° in the hatching compartment will better suit this breed. For heavier breeds a wet bulb reading of 83° in the setting compartment and 93° in the hatching compartment seems to be optimum.

GENERAL HATCHING PROCEDURE

In most cases the manufacturers directions are given and should be followed until the operator becomes skilled in incubator operations.

The eggs are first placed on trays small end down and it is important to observe this rule. Hatching results can be seriously affected if the eggs are set with the small end uppermost. This is because the air cell is situated at the larger end of the egg and the chickens head must form at this point if it is to hatch. Let us assume that the incubator has previously been warmed to the correct temperature required for setting and the required humidity has been reached.

When placing the eggs in the incubator it is advisable to adopt the practice of first switching the machine off. Quite a few fingers have been lost through not observing this rule, and apart from this much of the valuable humidity will be lost.

If the operator intends to hatch only once weekly then the first hatch is dispersed evenly throughout the incubator and then the second the next week until the machine is running at full capacity. It is not advisable to set the eggs in a wall one week and then in a wall the second week as cold spots can be created in the machine and consequently the eggs take a greater time to warm up than when even distribution, is practiced.

The hatch from each week must be clearly distinguishable from any other to enable identification at the time of transfer to the hatching compartment.

The eggs are then incubated for 18 days in the setting compartment and throughout this period correct temperature and humidity levels must be sustained.

It is necessary to turn the eggs night and morning at regular times.

Most hatcherymen candle the eggs at the six and 18 day periods. All clears and dead shell are removed. For further information re candling see section entitled. Candling the eggs.

On the 19th day the eggs are then transferred to the hatching compartment where all the necessary humidity and temperature adjustments have been made. The eggs remain in this compartment for the remaining three days and are no longer subjected to turning.

During this hatching period close watch should be kept on the temperature. As the animal heat increases so does humidity and temperature and therefore extra ventilation is needed. This is provided by opening up the vents sufficiently to counteract the increase in humidity and temperature of the inlet and outlet vents. The inlet and the outlet vents should be opened an equal amount.

On the 21st day the heat may increase beyond the control of the vents and the thermostatic control. This is because the heat being generated has increased to a pitch beyond the control of these two mechanisms. Should this condition arise the hatched chickens must be removed to avoid overheating and eventual death of the chicks. It will probably be found that the hatch is complete.

This increase in heat may arise before the 21st day as sometimes occurs in the summer hatching period, then it may be necessary to open the machine to avoid the overheating of the chicks.

Those intending to hatch during the summer period should take precautions to keep the incubator room at a set controlled temperature.

When the hatch is complete the chicks should be taken off and placed in good clean chick boxes and stacked in racks in such a manner that they will not overheat and suffocate. Chicks in boxes should never be stacked in the sun. After sexing, the chicks are disposed of to the clients or to the hatcherymen's brooders.

STORING EGGS FOR INCUBATION

Hatcherymen may receive the eggs from the breeders twice weekly or once weekly. They may for some reason wish to store eggs for a longer period to cover a large order.

It is well known that the age of an egg affects its hatchability but the environment under which hatching eggs are stored is of greater importance.

INCUBATION PRACTICES

INCUBATION CHART FOR CHICKS

(T. S. Townsley, Hatchery Tribune, Jan., 1942)

SYMPTOMS OF TROUBLE	PROBABLE CAUSES	SUGGESTED REMEDIES
EGGS CLEAR No blood ring or embryo growth	1. Improper mating. 2. Eggs too old. 3. Breeding hens too thin. 4. Birds too closely confined.	1. Eight to ten vigorous males per 100 hens. 2. Eggs set within 10 days after date laid. 3. Keep hens in good flesh.
EGGS CANDLING CLEAR But showing blood or very small embryo on breaking.	1. Incubator temperature too high. 2. Badly chilled eggs. 3. Breeding flock out of condition (frozen combs, chicken pox, etc.). 4. Low vitamin ration.	1. Watch incubator temperatures. 2. Protect eggs against freezing temperatures. 3. Do not set eggs from birds with frozen combs or with contagious diseases. 4. Feed fish oil and alfalfa.
DEAD GERMS Embryos dying at from 12 to 18 days.	1. Wrong incubation temperature. 2. Lack of ventilation. 3. Faulty rations.	1. Close temperature regulation. 2. Plenty of fresh air in incubator room and good ventilation of machines. 3. Feed yellow corn, milk, alfalfa meal and fish oil.
CHICK FULLY FORMED But dead without pipping.	1. Improper turning. 2. Heredity. 3. Wrong temperature.	1. Turn eggs four times daily. 2. Select for high hatchability. 3. Watch incubator temperature.
EGGS PIPPED Chick dead in shell.	1. Low average humidity. 2. Low average temperature. 3. Excessive high temperature for short period.	1. Keep wet bulb temperature from 85 to 90 degrees. 2. Maintain proper temperature throughout hatch. 3. Guard against temperature surge.
STICKY CHICKS Shell sticking to chick.	1. Eggs dried down too much. 2. Low humidity at hatching time.	1. Carry wet bulb temperature of 85 degrees between hatches. 2. Increase wet bulb reading to 88-90 degrees when eggs start pipping.
STICKY CHICKS Chicks smeared with egg contents.	1. Low average temperature. 2. Small air cell due to too high average humidity.	1. Proper operating temperature. 2. Increase ventilation and lower humidity.
ROUGH NAVELS	1. High temperature or wide temperature variations. 2. Low humidity.	1. Careful operation. 2. Proper humidity.
CHICKS TOO SMALL	1. Small eggs. 2. Low humidity. 3. High temperature.	1. Set nothing under 23 oz. eggs. 2. Maintain proper humidity. 3. Watch incubator temperature.
LARGE SOFT BODIED CHICKS	1. Low average temperature. 2. Poor ventilation.	1. Proper temperature. 2. Adequate ventilation.
MUSHY CHICKS Dead on trays, with bad odour.	1. Navel infection in incubator.	1. Careful fumigation of incubators between hatches.
SHORT DOWN ON CHICKS	1. High temperature. 2. Low humidity.	1. Proper temperature. 2. Careful moisture control.
HATCHING TOO EARLY With bloody navels.	1. Temperature too high.	1. Proper control of temperature.
DRAGGY HATCH Some chicks early, but hatch slow in finishing.	1. Temperature too high.	1. Proper operation.
DELAYED HATCH Eggs not starting to pip until 21st day, or later.	1. Average temperature too low.	1. Watch temperatures—check thermometers.
CRIPPLED CHICKS	1. Cross beak—Heredity. 2. Missing eye—abnormal. 3. Crooked toes—temperature. 4. Wry neck—nutrition (?).	1. Careful flock culling. 2. Matter of chance. 3. Watch temperatures. 4. Not fully known.
EXCESSIVE YELLOW COLOUR ON CHICKS	1. Too much formaldehyde—fumigation.	1. Follow directions on fumigation programme.

Compiled by T. S. Townsley.

There is conflicting information regarding the length of time it is safe to store eggs for hatching. Temperatures and the quality of egg have a bearing on the holding time.

The following is the result of an actual experiment.

EFFECT OF AGE AND TURNING ON HATCHING EGGS

Age in days	Group 1		Group 2	
	Per cent. Hatched	Per cent. Hatched	Per cent. Hatched	Per cent. Hatched
	Turned all eggs	Not turned all eggs	Turned all eggs	Not turned all eggs
1 to 10 days	44·5	39·5	55·1	48·6
11 to 20 days	34·3	35·0	41·7	41·6
21 to 28 days	13·6	18·1	17·9	24·5

This supports the contention that hatching eggs should not be held longer than 10 days before setting. It has also been found that there is little need for turning up to 7 days of age, however after this period it is desirable to turn the eggs daily.

It would seem the most desirable temperature for holding eggs is between 50° F. and 65° F. Lower temperatures also have an adverse effect on hatching.

The presence of high relative humidity during the storing of eggs may also increase hatchability.

CANDLING THE EGGS

Candling or testing the eggs is a relatively simple operation and in most of the larger hatcheries is carried out on the last 5 days before transferring to the hatchibator.

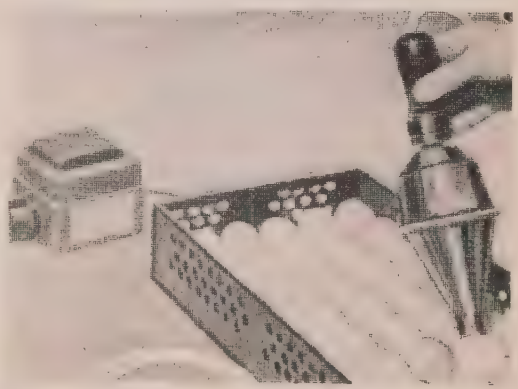
However if the hatcheryman has decided to sell the incubator clears to a cake making concern the eggs should be candled after approximately 6 days of incubation.

Also it is not wise to allow the clears and dead germs to remain in the incubator for the full period for dead germs are prone to go rotten and burst within the incubator and contaminate it. Clears take up room which is valuable to the chicks when they commence to hatch. A special slit type canding machine is used and the trays filled with eggs are passed over the opening in the candling machine which is lit by electric globes, the eggs to be rejected show up quite clearly.

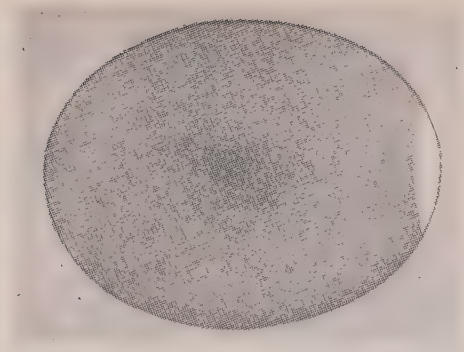
The detection of fertile eggs, after a few days of incubation, using a source of illumination from beneath the eggs. (Factors affecting incubation, British Oil & Cake Mills Ltd.)

In small establishments it is usual to use a small candling lamp. This is passed over the top of the eggs by the operator and all rejects removed as they are detected (see below).

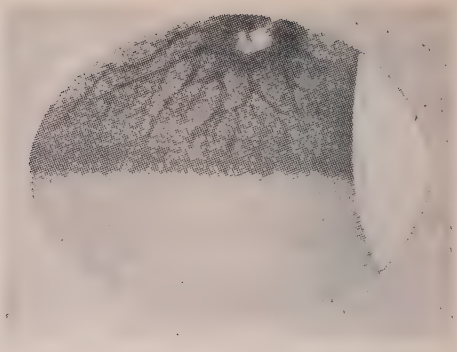
The rejected eggs consist largely of infertiles and dead germs. Apart from these, eggs with cracked and porous shells should be removed.



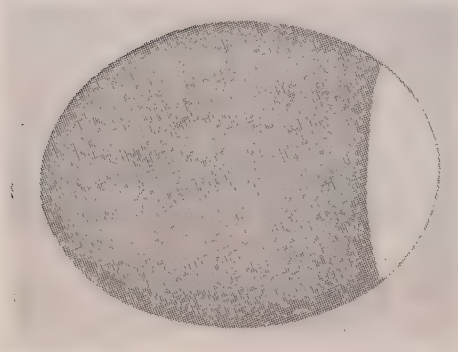
Using the small candling lamp.



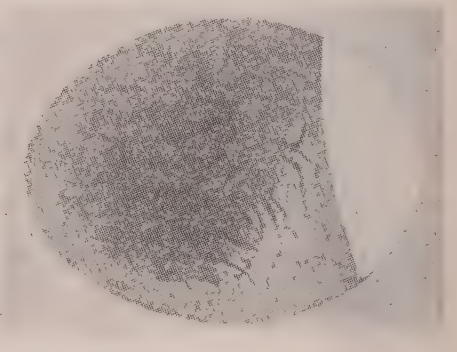
New laid egg. Note small air cell.



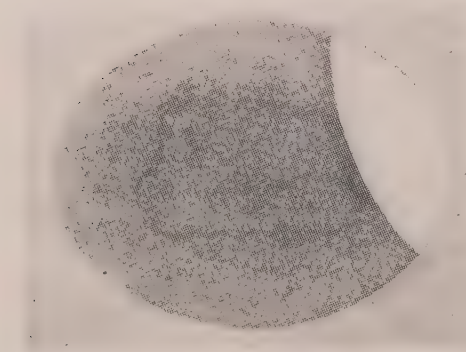
A fertile egg showing embryonic development after seven days under incubation.



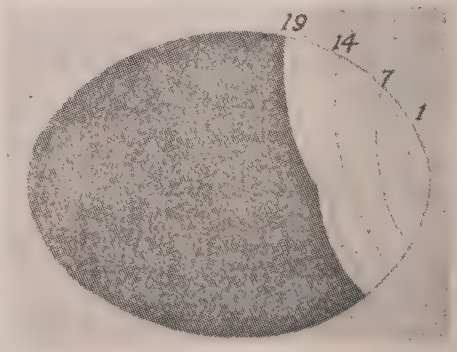
Infertile egg after seven days in incubation.



Embryonic development at fourteen days (nearly all opaque).



Egg showing a broken yolk. This will not produce a living chicken even though some embryonic development may have taken place.



Embryonic development as seen at nineteen days. Quite opaque except for the air space marked 1 to 19 days.

(After J. P. C. Smith "Incubation"—New South Wales Department of Agriculture.)

To leave the subject of candling here would leave the reader somewhat puzzled as to the meaning of infertile or dead germ. An infertile egg is one that after several days of incubation still shows no sign of embryonic development, and a dead germ is one that has begun to develop but has died at an early stage, (usually denoted by a thin ring of blood which passes around the internal circumference of the egg, approximately at the base of the air cell.)

SANITATION OF ROOM AND STAFF

Today large masses of chickens are hatched together and thus the spread of disease amongst these masses could be considerable if careful attention is not given to sanitation within the hatchery. The eggs entering the hatchery, the attendants, chick boxes and equipment are all possible sources of disease. Omphalitis, CRD, etc., are diseases that once contracted result in ultimate death of the chicken or severely retard its growth and these diseases can be introduced into the hatchery if proper care is not taken.

It is therefore apparent that to safeguard his reputation and protect his chick buyers the hatcheryman cannot spare any pains in the sanitation programme of his hatchery.

Appearance of the staff will be enhanced if a clean dustcoat is worn and in the hatchery will partly assure that disease introduction through attire is limited.

Attendants should not be allowed to enter the hatchery in outdoor working clothes.

A clean hatchery, painted and free of dust not only create a good impression but could help control disease.

Sick chickens which are returned to the hatchery by customers should not be allowed to enter the incubator building itself but should be examined in a separate building. If it is deemed necessary live specimen chicks should be forwarded to the Department of Agriculture for post mortem examination.

Used chick boxes should be well fumigated and stored in a room separate from the hatchery premises.

Eggs from suppliers should also be packed in a special packing room.

Brooders within the hatchery should always be well disinfected and used only for display purposes.

The chicken sexer should always have access to a supply of disinfected water to wash his hands.

A tray of disinfectant outside the incubator room door to control the introduction of disease on shoes should also be provided.

Dust should be kept at a minimum and a light spreading of disinfected water on the incubator room floor daily is advisable.

The hatching compartment should be thoroughly scrubbed after each hatch and the necessary fumigation programme followed.

Hatchery equipment such as incubator trays, battery brooders, etc., should always be kept completely sterilised. One of the better class sterilising agents of which there are quite a few on the market should be used to sterilise the equipment per medium of a good scrubbing. The hatchery floor should also be scrubbed periodically with the sterilising agent preferred.

FUMIGATION

Because of the possibility of bacteria entering the machine via the egg, etc., it is necessary to adopt some precautionary measures to combat these germs. This is done by carrying out a fumigating process with formaldehyde gas.

At this point it is advisable to add a word of caution. Fumigation should not be carried out between the 24th and 96th hour after setting, as, during this period, the susceptibility of the embryo to adverse conditions is at its greatest and some embryonic mortality could occur.

Outside this period fumigation can be carried out at any time. There is no advantage in fumigation after hatching and is certainly not advisable after the chicks have commenced to dry out.

Incubator operators who are obliged to incubate and hatch in the same compartment should pay close attention to fumigation and avoid fumigating during the danger period.

It is desirable that the period of fumigation be as long as possible.

FUMIGATION ILLUSTRATIONS

(1) Preparing the fumigants. The bottle contains formalin and the large container on the right holds permanganate of potash. The operator is placing the permanganate into the receptacle to be used for mixing the fumigants.

(2) A measure of formalin has been added to the permanganate and the fumes may be seen rising. This was done for demonstration purposes only. In practice, the mixing would be done in the incubator so that none of the fumes would be wasted, and a porcelain receptacle would be used in preference to the tin.

(3) Illustrating the actual fumigation of the setting compartment while the eggs are in the machine. Formalin is about to be added to the permanganate in the tin.

Procedure for Fumigation.

(1) Calculate the size of the inside of the incubator making no allowance for space occupied by eggs or trays. To do this, measure the length, breadth and height of the interior of the compartment in feet and multiply the three figures together.

(2) Measure out the proper quantities of formalin and potassium permanganate according to the size of the incubator. It may be more convenient to have these amounts put up by the chemist from whom they are purchased.

(3) Place the potassium permanganate in a wide china, earthenware or enamel basin. This should be sufficiently wide and deep to prevent splashing as some frothing occurs when the two ingredients are mixed. The bowl is then placed in a level position on the floor of the incubator, near the door.

(4) Close the vents and bring the temperature and humidity to the correct levels for fumigation (dry bulb 100° F., wet bulb 90° F.).

(5) When both temperature and humidity are correct shut off the motor, open the door, add the formalin to the potassium permanganate in the basin, close the door and turn the motor on immediately.

(6) Allow the fumigation to proceed for the appropriate time (approx. 30 minutes).

(7) Remove the bowl containing the used material, leave doors and vents open and run the motor for about five minutes to get rid of the formaldehyde.

(8) Shut doors and return machine to its normal setting.

The above instructions are written primarily for large forced-draught machines and some adaptation may be required for use in smaller incubators. In still-air models considerable variation is likely to occur in the concentration of gas in different parts. For this reason the amounts of formalin and potassium permanganate should be increased slightly in order that the maximum lethal concentration will be obtained throughout.

Pedigreed chicks in box. The number on the tickets indicate the parentage of the chicks.

Unlike forced-draught machines the hot-air types have a different system of ventilation and as these systems vary considerably according to the make and size of the machine, it is essential that all ventilators be closed while fumigation is being carried out. The temperature of hot-air machines should be maintained at 103° F. and the wet bulb at 93° F. during the fumigation period.

Internal Sizes of some Commonly Used Incubators

(1) "Lanyon" still air, 120 egg capacity: approx. 2 ft. x 2 ft. x 1 ft = 4 cubic feet.

(2) "Multiplo" 1,350 egg capacity: 3 ft. x 2½ ft. x 4 ft = 30 cubic feet.

(3) "Gamble" 4,000 capacity—
(Setting compartment) = 3 ft. x 5 ft. x 5¼ ft. = 79 cubic ft (approx.).
(Hatching compartment) = 3 ft. x 2½ ft. x 5¼ ft. = 39 cubic ft. (approximately).

Estimation of Ingredients Required for Fumigation

Example:

Inside measurements of incubator: 3 ft. x 6 ft. x 5 ft. = 90 cubic ft.

Using 75 c.c. formalin and 50 grammes potassium permanganate per 100 cubic feet 90 c. ft = 9/10 of 100 c. ft.

Amount of formalin required = 9/10 x 75 = 67.5 c.c.

Amount of pot. permang. required = 9/10 x 50 = 45 grammes.

Note.—To convert c.c. to fluid ounces or grammes to ounces divide by 30. This will give an approximately correct result, e.g., 75 c.c. = 75/30 = 2½ fl. oz. (approx.).

Ingredients required for incubators of various sizes, using 75 c.c. formalin and 50 grammes potassium permanganate per 100 cubic ft. (if 150 c.c. formalin and 100 grammes potassium permanganate are used, double these quantities will be required):—

Incubator space	Formalin required	Pot. permang. required
4 cubic ft.	3 c.c.	2 grammes
30 ,, ,, ...	22·5 ,,	15 ,,
40 ,, ,, ...	30 ,,	20 ,,
80 ,, ,, ...	60 ,,	40 ,,
120 ,, ,, ...	90 ,,	60 ,,
175 ,, ,, ...	131 ,,	87·5 ,,

Fumigation Methods.

It is recommended that incubators be fumigated with formaldehyde gas. Formaldehyde is obtained as a 40 per cent. solution in water, known as formalin. The gas can be produced from this solution by (a) simple evaporation or (b) by mixing with potassium permanganate.

(a) In the former method, pieces of cheese-cloth about one yard square are soaked in the required amount of formalin (40 c.c. or approximately 1½ fluid ounces per 100 cubic feet of incubator space). These are then hung up near the fan so that evaporation takes place in a few minutes. In actual practice this method does not seem to be quite as efficient as the following alternative method which depends on the rapid generation of formaldehyde gas when formalin is mixed with potassium permanganate.

Sexing pedigreed chickens. The sexer is not working at full speed. For chicks for sale greater speed and better facilities would be needed.

Wing banding pedigreed chicks. Note the 15,000 force draft incubator in the background.

(b) For routine fumigation use 75 c.c. (2¾ fluid ounces) of formaldehyde and 50 grammes (1¾ ounces) of potassium permanganate per 100 cubic feet of incubator space. The fumigation should be continued for 30 minutes.

If an outbreak of disease occurs in the chickens it would be advisable to use a much larger amount of gas for at least one fumigation. For this, 150 c.c. (5¼ fluid ounces) of formalin and 100 grammes (3½ ounces) of potassium permanganate are recommended per 100 cubic feet.

It has been demonstrated that even the largest amount of gas mentioned above has no significant effect on hatchability when fumigation is prolonged for 30 minutes, provided the eggs do not already have some inherent fault such as weak germs and providing they have not been stored for a long period prior to incubation. In these latter cases the death rate of the embryos is increased somewhat.

The exact amount of each ingredient should be used. To use an insufficient amount of potassium permanganate means that the full amount of gas is not produced, while an excess of potassium permanganate is merely wasteful as it is not used.

Temperature and Humidity.

For efficient management of incubators the operator should be familiar with the use of wet bulb thermometers which are

used in conjunction with the ordinary dry bulb thermometer to determine relative humidity.

Fumigation is best carried out at a temperature of about 100° F. A high degree of humidity is desirable within the incubator for best results. During fumigation the relative humidity should be at least 68 per cent. This degree of humidity is obtained when the dry bulb thermometer reads 100° F. and the wet bulb thermometer reads 90° F.

In most large machines, closing the vents is all that is required to increase the humidity. In others it may be necessary to add additional water either in trays or by placing wet bags on the incubator floor. These should be removed as soon as the fumigation has been completed.

In conclusion, it must again be stressed that fumigation is only one step in the control of hatchery diseases.

Emphasis must be placed on efficient pullorum testing of adult poultry as the main line of defence. Good all-round poultry husbandry will effectively reinforce these measures.

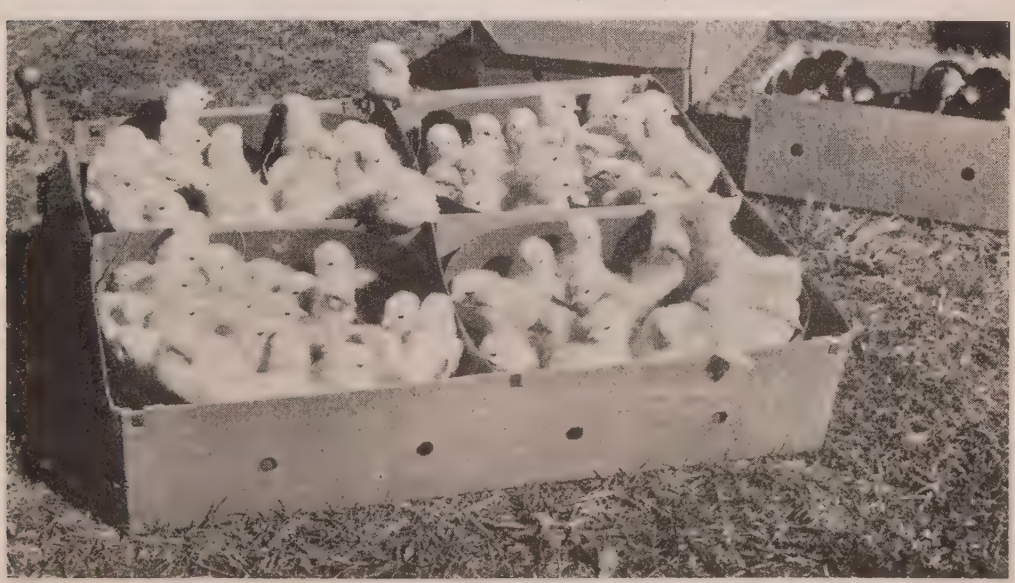
INTERESTING ODDMENTS

Incubation Periods.

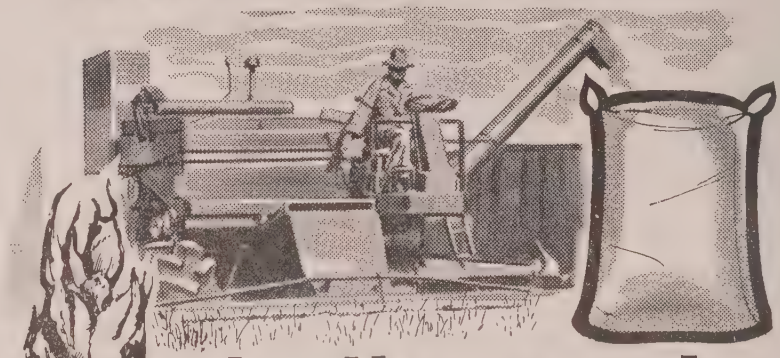
Hens, 21 days; ducks, 28 days; ducks Msc., 35-37 days; turkeys, 28 days; geese, 28-30 days.

EVENTS IN EMBRYONIC DEVELOPMENT
(Romanoff, 1931)

Before egg-laying:	Fertilisation Division and growth of living cells Segregation of cells into groups of special function (tissues)
Between laying and incubation:	No growth; stage of inactive embryonic life
During incubation:	
First day:	
16 hours	First sign of resemblance to a chick embryo
18 hours	Appearance of alimentary tract
20 hours	Appearance of vertebral column
21 hours	Beginning of formation of nervous system
22 hours	Beginning of formation of head
24 hours	Beginning of formation of eye
Second day:	
25 hours	Beginning of formation of heart
35 hours	Beginning of formation of ear
42 hours	Heart begins to beat
Third day:	
60 hours	Beginning of formation of nose
62 hours	Beginning of formation of legs
64 hours	Beginning of formation of wings
Fourth day	Beginning of formation of tongue
Fifth day	Formation of reproductive organs and differentiation of sex
Sixth day	Beginning of formation of beak
Eighth day	Beginning of formation of feathers
Tenth day	Beginning of hardening of beak
Thirteenth day	Appearance of scales and claws
Fourteenth day	Embryo gets position suitable for breaking the shell
Sixteenth day	Scales, claws, and beak becoming firm and horny
Seventeenth day	Beak turns towards air cell
Nineteenth day	Yolk sac begins to enter body cavity
Twentieth day	Yolk sac completely drawn into body cavity Embryo occupies practically all the space within the egg except the air cell
Twenty-first day	Hatching of chick



more bushels . . .



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WORMS IN POULTRY

By H. D. SEDDON, B.V.Sc.

WORMS occurring in poultry in Western Australia include both round worms and tapeworms. However, the intestinal round worm (Ascaridia galli) which is found in the small intestine and duodenum is by far the most important and its effects the most serious.

The caecal worm (*Heterakis gallinae*), although not a serious cause of loss by itself, is of importance in that its eggs can carry an infection of Blackhead, a disease caused by a protozoan, *Histomonas meleagridis*.

The tapeworms, *Choanotaenia infundibulum, Raillietina echinobothrida* and *Davainea spp.* are not commonly seen, and are usually associated with poor sanitation in poultry establishments.

THE INTESTINAL ROUND WORM
(Ascaridia galli)

This large, round worm is a cause of considerable economic loss to the poultry industry in this Sate through delayed and unthrifty growth, loss of birds and the delay in onset of egg-laying it causes. These signs are seen especially under poor conditions of management, as birds suffering from deficiencies in protein, vitamin A, or vitamin B_2 (riboflavin) are more susceptible to infestation than are well-fed birds.

The worm is common and widespread. It is yellowish white in colour, measuring about one-sixteenth of an inch in diameter and 2 to 5 inches in length, the male being smaller than the female. It may be found in large numbers in the duodenum and small intestines, producing marked symptoms in young birds.

Life Cycle.

The life cycle does not involve any intermediate host. The female worm lays eggs which are passed from the birds and onto the ground where they may survive for up to 8 months in moist soil in the shade under optimal natural conditions or 15 weeks if exposed to sunlight. Direct sunlight or dryness kills them. The eggs develop in the open and can become infective in 10 days.

A bird is infested by swallowing the eggs in food or water, larvae hatching out in the gizzard or upper part of the small intestine. Ten days later, the larvae penetrate the duodenal wall where they stay for one week before re-entering the lumen of the small intestine. The hatching larvae take 100 days to reach maturity, when egg-laying completes the cycle.

Symptoms.

Young birds are more susceptible to infestation than adults, or those which have recovered from the previous infestation, so it is in 3 to 9 months old birds where they can cause greatest havoc. Birds deffcient in vitamin A, or the B series, are more susceptible.

The damage produced is twofold.

Firstly, the immature larvae which burrow into the intestinal wall cause haemorrhages and inflammation, which heal and result in the intestine becoming scarred and thickened. This results in birds suffering from diarrhoea and anaemia.

Secondly, toxic substances excreted by the mature worm cause the birds to become unthrifty, thin, and generally weak with a drop or, in the case of pullets, a delay in egg production. In heavy infestations, obstruction of the small intestine may occur.

The symptoms can be particularly severe in young birds, 4 to 5 months of age, where they occur after a week from infestation, but symptoms can occur as early as one month of age. There is a loss of appetite and increased thirst, and,

with heavy infestations, a frothy, mustard-coloured diarrhoea develops with paleness of comb and shanks, drooping wings and a hunched up, drowsy appearance. Development is arrested, weight gain slows down, and the birds may become emaciated. Pullets may fail to come into egg production for up to 2 to 3 months. Some birds may die.

Older birds also lose the colour of comb and shanks in a heavy infestation and show dull plumage and loss of weight in spite of increased food consumption. Egg production drops off. Eventually, marked anaemia and emaciation develop; but unless other causes intervene, death is less frequent than with young stock.

Diagnosis.

Diagnosis is based on the symptoms described above and confirmed by finding a heavy infestation in the intestine of a badly affected bird which has been killed for examination. This examination will reveal congested intestine with haemorrhages on the wall and a loss of tone and thickening in long standing cases.

The liver is also enlarged and congested, and small haemorrhages on its surface may result from larvae entering after penetrating the intestinal wall. Mortality can be as high as 35 per cent. as a result of enteritis caused by burrowing larvae, or later, due to weight loss and anaemia.

Treatment.

Treatment of infestations aims at expelling the parasites from the birds and housing in clean cages. Effectiveness of treatment is decreased if what are virtually "diseased premises" are not treated simultaneously.

The most convenient treatment for birds is with piperazine which is easily administered in the feed or water. Piperazine is available as the hydrate, adipate or citrate under a number of trade names. It can be fed in the mash at the rate of 1 lb. per 350 lb. of mash, or added to the water at the rate of 1 ounce per 3½ gallons for 24 hours following overnight starvation or deprivation of water for 12 hours. Since badly affected birds eat little, dosing through the water is the better method. A second treatment 10 days after the first is recommended to expel those larvae which have matured since the first treatment, as larvae are not susceptible to piperazine.

Two series of treatments at ages of 10 and 18 weeks before and after vaccination for fowl pox are recommended to ensure successful response to the vaccine, and prevent the setback of weight gain encountered.

An alternative treatment is by individual drenching at 10 and 18 weeks of age with carbon tetrachloride. This treatment ensures that every bird receives treatment, which may not always occur when piperazine is fed in the mash to heavily infested birds which do not eat well. However, it presents drawbacks, in that more labour is required to complete the deworming programme and there is the danger of some losses of birds due to toxicity of the chemical.

A dose rate of ¾ cc. of carbon tetrachloride per pound live weight is to be used, and usually 1½ ccs. is adequate at 10 weeks of age and 2 ccs. at 18 weeks. If the birds are heavier, the dose may be increased, up to a maximum of 3 ccs. Drenching should be done early in the evening following starvation from about 9 a.m. and one hour without water. This leaves the crop empty so that the dose can be administered directly into the crop with a long nozzled drenching gun. However, as one drop of carbon tetrachloride administered into the lungs can cause instant death, care should be taken in administration. This may occur if the gun enters the windpipe, or if a drop of the chemical passes into the lungs on withdrawing the nozzle of the gun, or by fumes from the nozzle entering the lungs on a very hot day due to rapid evaporation. Losses may not ocur in the hands of an experienced operator. Care should be taken that birds are not suffocated by overcrowding when they are being caught.

Birds should have access to both food and water immediately after drenching.

Treatment with Nicotine Sulphate has been found successful, but less efficient than piperazine derivatives or carbon tetrachloride. Capsules containing tetrachlorethylene may also be used for individual dosing of small flocks. The dose rate is the same as for carbon tetrachloride and capsules are available con-

taining ½ cc. or 1 cc. Losses from the vermifuge entering the lungs are eliminated by this method of treatment.

Control.

The control of round worm infestation should begin with treatment, combined with steps to reduce and prevent the contamination of the ground by worm eggs. As sunlight and dryness are both lethal to the eggs, these should be utilised to their fullest extent in planning of poultry cages. Reservation of a section of the farm solely for raising replacement stock is a sound practice, and old birds should not be kept on it, as they are a source of worm eggs. The use of watering points which are actually outside the cages, and wide eaves to prevent rain entering the shed are advised to keep the inside of the cages dry and these combine well with the deep litter system of management. Five per cent. lysol (1 ounce of lysol to 1 pint of water) is recommended to kill ova where wooden or concrete floors are in use. Spelling of cages will allow the eggs to die in time.

Standard treatments of all birds, whether they show signs of infestation or not, with two medications of piperazine 10 days apart, both at 10 and 18 weeks of age is ideal for control. More treatments should be carried out as necessary, as the long survival of eggs allows infestation to build up all the time.

THE CAECAL WORM
(Heterakis gallinae)

Infestation with this worm is very common in this State, but apparently it does little or no harm by itself even when infestations are very heavy. It is a white worm measuring ¼ to ½ inch in length and occurs in the two caecae of its host. The life cycle does not involve any intermediate host and infestation results from the swallowing of eggs with food or water. Larvae hatch in the intestine and burrow into the wall of the caecae, but produce very little damage. Hached larvae take 24 days to mature.

The importance of this parasite is that its eggs can harbour the causative agent of Blackhead (*Histomonas meleagridis*) which does not survive conditions outside its host very well. Thus it can be responsible for the spread of this disease.

Treatment with phenothiazine is quite effective, and is conveniently mixed in dry feed at the rate of ½ ounce per lb. for 6 consecutive days.

Hygiene and shed design as described for the control of *Ascaridia galli* also apply here.

POULTRY TAPEWORMS

Tapeworms are uncommon in poultry in W.A. and when they are found it is not usually in large numbers. Tapeworms are usually a problem only under conditions of poor sanitation and only rarely are they the cause of death. However, light infestations may predispose to other diseases.

Three species of tapeworm occur in poultry in this State:—

(1) *Choanotaenia infundibulum* which occurs in the small intestine and is up to 8 inches in length. It passes a stage of its life cycle in an intermediate host, which in this case can be the house fly or a number of different beetles. The life cycle is completed by the fowl swallowing the beetle.

(2) *Raillietina echinobothrida* also occurs in the small intestine and measures up to 9 inches in length. Its intermediate host is an ant, which, when swallowed, releases a larval tapeworm which will mature in 19 or 20 days. Occasionally these tapeworms may produce nodules on the bowel wall.

(3) *Davainea spp.* These tapeworms are very small, measuring only up to one eighth of an inch in length. They only have 4 to 9 segments attached to the neck which is anchored onto the wall of the duodenum. Its eggs are rapidly killed by frost or drying and the intermediate host is a slug.

Symptoms of tapeworm burden are not often seen even in very heavy infestations, and the best evidence of their presence is on discovery after a dead bird has been examined, or when a bird has been killed for some other purpose. Then they are seen as long, flat many-segmented worms whose narrow end is attached to the bowel wall while the wider end hangs free.

Occasionally signs of diarrhoea, a capricious appetite, dull plumage and emaciation are seen in heavy infestations.

Treatment with 1 to 2 ccs. of carbon tetrachloride given as a drench is advised but is not very effective, as the mature segments drop off but the heads often remain behind to produce more segments. Therefore treatment is only of value in heavy infestations.

Control through improved sanitation and nutrition under which infestations may be thrown off are advised and access to the intermediate hosts should be prevented. Birds on free range are, for this reason, more prone to infestation than those housed in close cages.

As the intermediate hosts include flies, beetles, slugs and snails, fowl droppings should not be used as fertiliser for manuring green fodder intended for consumption by poultry, lest the life cycle of the parasite be completed. Dusting poultry runs with copper sulphate (bluestone) to control intermediate hosts is also advised.

HOW TO SUBMIT INSECT SPECIMENS FOR IDENTIFICATION

By C. F. H. JENKINS, M.A., Government Entomologist

FROM time to time most farmers and orchardists come across insects or other small creatures which they have not seen before and about which they would like some information. I get numerous queries about such creatures and am always glad to help, but sometimes the task is made unnecessarily difficult. The most detailed description of a caterpillar or a beetle given by letter is often quite useless as many of the most important features from the scientific point of view may be omitted.

Whenever inquiries are being made about even the commonest of insects, specimens should always be forwarded.

In the case of fully mature insects, some dead specimens in a small box will usually prove adequate. For preference, they should be wrapped or padded with tissue paper to stop them from rattling about and losing their limbs. On no account should they be wrapped in cotton wool as the legs and feelers become so entangled that casualties are almost inevitable when the specimens are being unpacked.

Where caterpillars are concerned, these should be forwarded alive, if possible, with a quantity of the food plant. It is often very difficult to accurately identify caterpillars but if they can be reared to maturity the task is much easier.

In no account should insects alive or dead (especially if they are rather fleshy) be forwarded in closely sealed tins or bottles. Even in cold weather they are often too decomposed to identify and in the summer the aromas which quite small insects can produce after being sealed up for a while must be experienced to be fully apreciated. A cardboard box is usually a satisfactory container, especially when caterpillars and food plants are involved.

Some specimens, especially very small ones, can be safely forwarded in methylated spirits or formalin but bottles should be carefully packed to avoid breakage.

It should be remembered that when information is wanted about any creature, several specimens should be sent if at all possible. Full particulars should also be given as to the prevalence of the insect, where it was found, and the type of damage it was doing. The name and address of the sender should accompany the specimens even if a covering letter has been forwarded independently.

Whenever you see a strange insect about which you have any suspicions, don't hesitate to send in an inquiry.

Pure lines of seed are obtained by bagging heads

Castor Beans IN TRIAL PLANTINGS

"Bundidup" Research Station, Wokalup, 1959-60

By T. PAVY, B.Sc. (Agric.), Adviser, Dairy Division

THE main producing countries of the world are Brazil, India, U.S.S.R. and U.S.A. This means Australia has to import her supplies of castor oil, which has led to great interest in the possibility of growing castors in Australia. Since the turn of the century, this interest has been increasing, and has accelerated in recent years, but it has never passed the experimental stage.

In this State experiments, carried out in the 1920's, showed that good yields could be expected with castor beans grown on sands. It was not until this last summer that more work has been carried out.

At the end of last year 15 varieties of castor, obtained from U.S.A. and N.S.W., were planted at "Bundidup" Research Station, Wokalup. They were planted in a non-replicated trial on a Langham loam, which was accessible to irrigation waters. Planting was delayed until the first irrigation water was available on 3rd December, 1959. Three rows, each three feet apart were sown of each variety, seed was sown 12 in. apart in the rows. Because of difference in seed size, the seeding rate varied from 5 to 21 lb. per acre, as seen in Table 1. The plots were fertilised with a 3 : 2 : 1 mixture at a rate of 6 cwts./ac. then later, five weeks after germination, they received a side dressing of 1 cwt./ac. of sulphate of Ammonia.

TABLE I
Seeding Rates

Variety	Seed Sown
	lb./acre
Cimarron	13
Kentucky 38	18
Nebraska	11
Baker Hybrid 45	10
Hybrid 415	12
Baker Inbred 296	9
U.S. 4	10
Interspersed Dawn	9
Baker	10
D'anjou	11
Kirripi Wild	5
Mauthner's Dwarf	10
Ryde	8
U.S. 74	9
Connor	21

Irrigation.—The plots received four irrigations. The first to germinate the

seeds on 3rd December, followed by waterings on 30th December, 1959, 29th January, 1960, and 19th February, 1960. These were all flood irrigations and some were a little patchy. Heavy rains around the New Year helped a lot, and brought through some more seedlings, which rather suggests a heavier watering at germination was required.

Emergence.—All varieties germinated and emerged within 5 days of each other, i.e., from 8 to 13 days from sowing to emergence. This difference was increased to 22 days to flower. The shortest time was 40 days for Mauthner's Dwarf and the longest was 62 days for Connor. Again the difference in time between varieties increased to 57 days for harvest. Table 2 shows the various days to growth.

TABLE 2

Number of Days to various phases of plant growth

Variety	Number of Days from Sowing to—			
	Emergence	Bud	Flower	Harvest
Cimarron	11	....	50	204
Kentucky 38	11	38	44	204
Nebraska	11	40	48	162
Baker Hybrid 45	13	43	52	204
Hybrid 415	13	40	53	197
Baker Inbred 296	11	....	55	204
U.S. 4	8	....	41	147
Interspersed Dawn	13	40	61	197
Baker	11	40	48	182
D'anjou	8	....	40	172
Kirripi Wild	11	40	43	204
Mauthner's Dwarf	11	....	40	151
Ryde	11	40	48	Some 106
U.S. 74	11	40	40	181
Connor	11	40	62	Some 162

Thus the castor varieties planted the beginning of December needed a growing period of 150-200 days. This is too long at this time of the year, as wet conditions prevailed at harvest time. In the coming season planting will be done earlier in the summer.

The 15 varieties were all of the dwarf type ranging in height from 21 in. to 45 in. Connor was the exception with an average height of 70 in. The varieties ranged in colour from bright green through dark green to reds. The red varieties were the tallest. D'anjou, Mauthner's Dwarf and U.S. 4 were much branched types, which shed their leaves readily when fruit was mature. This is a necessity in machine harvesting. Where the leaves are not shed, a killing frost or a defoliant is needed before a harvester can be used.

A few seedlings were lost due to wireworm attack, but there was a 57 per cent. germination and survival of all seed sown. Table 3 shows the percentage of each variety.

Germination may be irregular unless adequate irrigation is given

The plants were not affected by any other pests or diseases. Parrots nibbled a couple of fruit, but did not come back for any more.

TABLE 3

Percentage emergence and survival of plants

Variety	Emergence 8 Days		
	Emergence	Plants Dec. 30	Plants Jan. 12
	%	%	%
U.S. 4	13	73	73
D'anjou	1	55	54
	Emergence by the 11th Day		
Kirripi Wild	5	39	77
Mauthner's Dwarf	17	41	41
Ryde	27	54	65
Kentucky 38	27	66	67
Nebraska	12	51	56
U.S. 74	3	54	56
Baker	2	24	38
Baker Inbred 296	9	35	57
Cimarron	2	33	52
Connor	3	24	38
	Emergency by the 13th Day		
Interspersed Dawn	2	22	25
Hybrid 415	9	31	48
Baker Hybrid 45	3	37	51

As Castors freely cross pollinate, a number of spikes of each variety were bagged to obtain pure line seed. This

consisted of placing a cotton wool wad around the pedicel, then placing a plastic bag covered by a calico bag, all tied around the cotton wool wad. The high temperatures and high humidity produced inside the bags caused rotting, burning, and a tendency to maleness, thus getting very few fruits. As all times had been recorded a system was evolved so that least possible damage was caused and pure line seed obtained.

The yields of seed varied between varieties ranging from 521 lb./ac. to 3,226 lb./ac., (see Table 4). The two varieties Ryde and Connor were not ready for harvesting at the end of July, and at that time were making new growth and setting new fruit. Both varieties were red types.

TABLE 4
Yields of Castors

Variety	Yield
	lb/acre
Cimarron	3,226
Kentucky 38	2,801
Nebraska	2,494
Baker Hybrid 45	1,850
Hybrid 415	1,673
Baker Inbred 296	1,547
U.S. 4	1,448
Interspersed Dawn	1,395
Baker	1,361
D'anjou	1,183
Kirripi Wild	845
Mauthner's Dwarf	814
Ryde	*660
U.S. 74	521
Connor	*374

* These are only some of the fruit harvested. Total yield may be double these.

The yields compare favourably with those overseas, in many cases our yields being higher.

The percentage oil in all cases was higher than figures obtained overseas. These ranged from 9 per cent. to 12 per cent. higher. The results of the oil analysis will be seen in Table 5. The Australind variety was seed harvested from a wild variety found at Australind. It will be noted that all the varieties grown in the trial had a higher oil content.

Varieties vary in leaf shape and colour

TABLE 5
Percentage of Oil

Variety	Oil Content dry basis	Variety	Oil Content dry basis
	%		%
Cimarron	57·4	Kentucky 38	57·0
Nebraska	58·8	Baker Hybrid 45	53·2
Hybrid 415	55·1	Baker Inbred 296	55·5
U.S. 4	56·2	Baker	56·1
Interspersed Dawn	57·0	D'anjou	56·9
Kirripi Wild	54·3	Mauthner's Dwarf	54·6
Ryde	56·0	U.S. 74	56·4
Connor	58·8	Australind*	49·2

* Local Wild Variety.

CONCLUSION

Under conditions prevailing at "Bundidup" Research Station, Wokalup, Castor Beans gave good yields with high percentage of oil in this preliminary trial. These compare more than favourably with overseas results. Further work is needed to find out suitability of varieties, time of planting, fertilisers, watering, soils, and harvesting under Western Australian conditions.

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DWARF FRUIT TREES

By F. MELVILLE, B.Sc. (Agric.), Adviser (Fruit)

IN this country where most fruits and particularly apples and pears are grown without irrigation, heavy crops and summer stress restrict tree size. The aim of most growers therefore, has been to grow larger trees and little interest has been shown in trees with dwarfing tendencies. However, in countries with ideal conditions for growth, trees tend to grow too big and become uneconomic in terms of labour costs.

This is particularly so with apples in the United States of America where the use of seedling stocks has resulted in extremely large trees which are awkward to prune and spray, and expensive to pick. In the United Kingdom and Europe seedling stocks for apples went out of use many years ago for this very reason and the only relics to be seen are standard trees in the old farm orchard. English growers have taken advantage of the selection of apple stocks developed at the East Malling Research Station in the 1920's to produce small trees on such stocks as Malling II, IV and the very dwarfing IX. Malling IX is also widely used in continental countries such as Holland.

There are certain advantages in small trees. Cropping commences earlier, the fruit is within easy reach, the tree management is simplified and more trees can be planted per acre giving a greater yield especially in the early years. Trials were seen in England last year with as many as 1,350 trees to the acre planted in hedgerow fashion and trained as dwarf pyramids. Production per acre in the first 10 years was three times that for an orthodox wide planting on a more vigorous stock. In Holland too, advantage was being taken of the dwarfing effect of Malling IX, to close plant trees developed on the spindle bush system. The main use of dwarf trees in England, however, is as interplants in an orthodox orchard to boost production in the early years. By this means per acre yields are almost doubled in the first ten years after which the interplants are removed if crowding has occurred.

A trial planting of Golden Delicious on Malling IX trained on a trellis in a Washington orchard U.S.A. was expected to yield something approaching 500 bushels per acre—that is one bushel per tree in the second year. In Canada too, trials have given good results. Although the trees are dwarfed fruit size is quite normal.

However, Malling IX has a rather poor root system and trees need stacking. The Americans have a method of overcoming this problem by using a seedling root and

grafting a small section of a dwarfing stock into the stem thus producing a dwarfing effect without the disadvantage of a poor root system. Either Malling IX or VIII are used as the stem piece the latter in the well known "Clark Dwarf" which also incorporates a section of Virginia Crab in the lower stem to resist cold.

The East Malling selection Malling 26 which is much better anchored and only slightly more vigorous may prove a suitable substitute for IX.

Pears can also be dwarfed by working on quince roots. This also encourages earlier cropping and is used to advantage in the United Kingdom and Europe. The Bartlett, however, makes a very unsatisfactory union with quince and to overcome this difficulty it is necessary to use an interstock of another pear variety such as Beuree Hardy. Very little of the interstock material is necessary to give a satisfactory union. In one technique known as "double budding," portion of a bud shield of the interstock is inserted into the normal T cut in the quince stock followed by a normal bud on top. The small section of bark and cambial tissue of the interstock between the quince and the Bartlett bud is sufficient to produce a perfectly satisfactory tree.

But what is the possible value of dwarfing stocks here? For apples we have long used Northern Spy which has slight dwarfing tendencies and gives early cropping. The present trend is towards seedling stocks which can be expected to produce large trees under favourable conditions and may be slow to crop unless handled carefully. The main use of dwarfing apple stocks would be to enable closer planting giving greater and more economic yields. Overseas evidence indicates that provided soil moisture is adequate serious tree competition only results from lack of sufficient light so that provided the trees are irrigated and have enough growing space production should be unaffected by proximity to adjacent trees. The most practical type of planting is a rectangular system allowing working room between the rows with trees planted close within the rows.

A range of apple stocks was imported in recent years by the Department and among these are a few semi-dwarfing types. As sufficient trees become available close planting trials will be initiated.

RESIDUAL VALUE OF TRACE ELEMENTS

How Frequently Should Trace Elements be Applied to Soils?

DEPARTMENT OF AGRICULTURE RECOMMENDATIONS

Prepared by Plant Research and Animal Divisions

Over the last 30 years the magic of trace elements has converted millions of acres of wilderness into productive farmlands. To many farmers copper, zinc, manganese, molybdenum or cobalt has spelt the difference between disaster and security. Today the question is "How often should dressings be repeated?" Information on this aspect is being accumulated, but as it is not complete the following are interim recommendations.

COPPER

This element is needed by both plants and animals. However, the grazing animal requires a higher level of copper in the herbage it grazes than the plant requires for maximum growth, so sufficient copper must be applied to copper deficient areas to keep the level in the pasture high enough for maximum animal production.

It is therefore considered that pasture grown on an area known to be copper deficient should be topdressed with copper again five years after the initial application. On each occasion one bag (187 lb.) per acre of the standard super copper mixture should be used. This mixture contains the equivalent of 9¾ lb. of copper sulphate per bag: the copper compound used is ground copper ore of an oxidised type.

After the deficient area has been treated with two evenly applied dressings, copper need only be applied at ten year intervals, unless there is positive evidence of copper deficiency in the stock. Copper toxicity can occur in stock and is a potential danger if applications are repeated too frequently.

Except on three groups of soils which are limited in distribution there is no experimental evidence that copper is needed more than once for cereal cropping or pasture production. The limited areas where present information indicates that the standard application of copper should be repeated with each cereal crop, or every five years on pasture, are:—

(a) The coastal soils high in lime. Cereals are grown on the Dongara and West Northampton examples of this type.

(b) The main soil types of the Dandaragan and Gingin districts. Among these are the grey to brown coloured light soils of the flats which carried mainly flooded gum, and the red sandy soils originally carrying red gum and banksia.

(c) The gravelly soils overlying clay at shallow depths in the South Stirlings, Woogenellup and Newdegate districts which carry a mallee type vegetation in the virgin state.

ZINC

There is no evidence that zinc application to zinc deficient areas is needed more than once for crops or pastures except to ensure even distribution. The zinc application should be at one bag (187 lb.) per acre of the standard super zinc mixture which contains approximately 3 lb. of zinc oxide. It appears that the small quantity of zinc in ordinary super will provide a "maintenance dressing" and prevent the deficiency recurring.

MOLYBDENUM

There is no evidence in Western Australia of a response to more than one application of molybdenum provided the initial application is at a rate of 2 oz/ac of molybdenum oxide. This quantity of molybdenum is contained in one bag (187 lb.) of the standard super molybdenum mixture. It is very important to topdress molybdenum super evenly as the dressing is unilkely to be repeated.

Molybdenum can quickly build up to a level in the herbage which is toxic to stock and further dressings should only be used when there is positive evidence that the area has become deficient again. Only in limited areas of Australia is there substantiated evidence of a need for second molybdenum applications.

MANGANESE

Manganese deficiency mainly affects cereals on certain soils. There is no evidence that manganese applied with the super has any residual value and applications should be repeated with every cereal crop sown. Manganese super is normally used at a rate of 90 lb./acre—although on virgin soils higher phosphate applications would be an advantage. It has been found that 14 lb. of manganese sulphate per acre is quite satisfactory for most deficient areas. The standard manganese super mixture contains 28 lb. of manganese sulphate per bag (187 lb.). The position with subterranean clover is possibly different and is at present under investigation. Manganese deficiency affecting sub. clover is not a major problem.

COBALT

Cobalt is needed by stock, but not by plants, as far as is known at present. A deficiency is cheaply corrected by an application of super containing cobalt. If applied at a rate of 90 lb./ac. (i.e., 3 oz. cobalt sulphate per acre) the deficiency should be overcome for three seasons. The dressing should then be repeated.

Cobalt can also be given to stock as either licks or cobalt bullets. The economics of these methods compared with applications to the pasture depend on the carrying capacity. Where the carrying capacity reaches or exceeds a sheep per acre, it is cheaper to apply cobalt to the pasture than to use cobalt bullets.

Bulletins on trace elements available from the Department of Agriculture are:—

2529.—The Use of Copper & Zinc in the Cereal Growing Districts of Western Australia, by W. J. Toms (Jour. Agric. West Aust., 1958. 7. (Third Series), No. 2, 197-203).

2414.—Molybdenum for Subterranean Clover by E. N. Fitzpatrick. (Jour. Agric., West Aust., 1957. 6. (Third Series) No. 1, 65-68).

2509.—Manganese Deficiency in the Cereal Growing Areas of Western Australia by S. T. Smith and W. J. Toms. (Jour. Agric. West Aust., 1958. 7. (Third Series) No. 1, 65-70).

2532.—Manganese Deficiency of Subterranean Clover in Western Australia by W. J. Toms. (Jour. Agric. West Aust. 1958. 7. (Third Series) No. 2, 215-216).

2172.—Cobalt: Its Use to Control "Wasting Disease," by L. C. Snook. (Jour. Agric. West Aust. 1954, 3 (Third Series), No. 4, 443-446).

2650.—Cobalt Deficiency in Sheep and Cattle. Treatment using Cobalt "Bullets" by A. W. Williams. (Jour. Agric. West Aust. 1959, 8. (Third Series), No. 4, 389-393).

2682.—Copper and Cobalt Deficiency of Livestock in Western Australia, by H. W. Bennetts (Jour. Agric., West Aust., 1959, 8. (Third Series), No. 6, 631-648).

2465.—Minerals for Livestock by L. C. Snook. (Jour. Agric., West Aust., 1957, 6. (Third Series), No. 4, 485-488).

THIEVES OF GRAIN

Rome, Italy. It is estimated that rats, mice, insects, and fungi destroy enough food every year to feed 250 million persons for a year on a daily ration of about two pounds of cereal products.

The Food and Agriculture Organisation says in 1958 world production of all grains was 856 million metric tons, that the rodents, insects, and fungi "consumed" about 85.6 million tons and that "In a world in which millions still go hungry the reduction of such losses of food could play a significant part in the struggle to increase world food supplies."

In United States it has been estimated that each rat feeding on stored grains costs the farmer six dollars a year.

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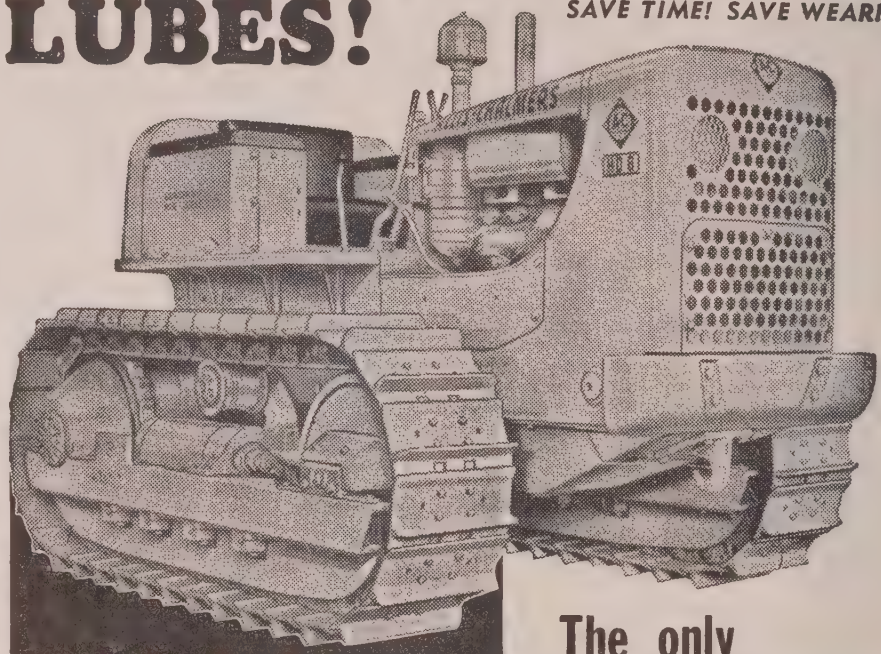

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INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

METHODS of insect control are sometimes classified under the following four headings—Quarantine, Cultural Methods, Biological Control and Chemical Treatments. Each method has its own particular part to play in preventing the spread and multiplication of insect pests and it is essential for maximum results that everyone—whether he be a commercial grower or a backyard gardener—has a general understanding of the principles involved.

QUARANTINE

There is a tendency for many people to regard quarantine as a function of the Government and to leave the matter entirely to authorised officials. Most regulations make dull reading and the quarantine literature is no exception; consequently few people are even aware of the existence of many of the regulations, much less the reasons for their promulgation.

The isolation of Australia has meant that many almost world-wide pests have so far failed to become established on this continent and that where they have done so some have failed to reach Western Australia. The rapid improvement of transport facilities in recent years has done much to bridge the gap between continent and continent and between State and State, and in consequence the importance of effective quarantine measures has greatly increased. It will be necessary to take only one or two examples to illustrate this point.

The codling moth for instance, is a major pest of apples and pears, which is widespread in the main apple-growing countries of the world, but which so far has failed to colonise Western Australia. This State's fortunate position has been maintained by a total prohibition on the importation of apples, pears and quinces from outside sources. The fact that numerous outbreaks of codling moth have occurred in Western Australia in the last sixty years reveals a weakness in the quarantine system, but the complete eradication of all these outbreaks indicates the value of the system as a whole.

Co-operation is Important.—One of the primary weaknesses in general quarantine is the lack of public co-operation. The difficulty of inspecting all interstate luggage (for instance) is self-evident and consequently there is ample opportunity for people to bring apples into Western Australia or to take other fruits to the Eastern States. South Australia, it should be noted, is not concerned about keeping out codling moth as the insect is already firmly entrenched. On the other hand, fruit fly is greatly feared and in recent years approximately £2,000,000 has been spent on eradicating this pest, and strict precautions are being observed to prevent further introductions. Within our own State the movement of fruit is restricted from the metropolitan area to such major apple-growing districts as Bridgetown and Mt. Barker, again with a view to preventing the permanent establishment of the

Mediterranean fruit fly in the southern portions of the State.

In the stock industry buffalo fly and cattle tick are of major importance, and both pests are well established in our Kimberley Division. The movement of cattle to the clean southern areas is only allowed for slaughter and then only in accordance with specified spraying or dipping regulations.

What applies to international or interstate quarantine applies to a lesser degree to individual properties. Care should be taken to see that clean material only, whether it be plant or animal, is introduced on to a farm or an orchard. Suspect animals or plants should be treated for the particular trouble in question and kept isolated until all risk is passed.

A classic example of biological control. The top picture shows an abandoned selection at Chinchilla, Queensland, in May, 1928, when the prickly pear had taken charge. Below the same scene is photographed in October, 1929. The prickly pear has ben destroyed by Cactoblastus cactorum, a moth imported from South America

The foregoing examples will have illustrated the importance of quarantine measures and the savings which they can mean to all members of the community.

The ever-increasing volume of air traffic is creating a special hazard and emphasises still further the necessity for public co-operation. What is required is that all members of the community should comply with quarantine regulations, whether the reason for the particular restriction is obvious or not, and that specimens of any suspect insect should be forwarded to the Department of Agriculture for indentification. The prompt submission of specimens has enabled numerous pests to be dealt with before they become established and the public's responsibility in this regard cannot be over-emphasised.

CULTURAL CONTROL

Although insecticides are an essential factor in controlling many of our insect pests, chemical methods of control must not be relied upon to the exclusion of all others.

Cultural methods are almost, if not quite, as important as spraying and dusting in combating many pests. Dirty borders and weedy plots will render the control of snails, red mite, and cutworms, an almost impossible task, while clean cultivation will greatly reduce the necessity of chemical treatments.

Grassy land should never be worked up and immediately planted unless such action is unavoidable. Seedlings grown under such conditions are in serious danger from a number of insect and allied pests. The weeds before being turned in would be supporting quite a large pest population, and although many of the creatures would be buried with the weeds, many would survive and other eggs would hatch, and with the weeds no longer available for food a concentrated attack on the young plants is inevitable.

A further corollary to clean cultivation is that useless plants should always be destroyed as soon as possible. For instance when cutting cabbages and cauliflowers the butts should be pulled up so as not to serve as further breeding places for cabbage moths and aphis, and as soon as tomato plants, potato tops, or bean runners have served their useful period they should also be quickly destroyed.

Crop rotation is another cultural practice which has much to recommend it. If the same kind of crop is grown time after time on the same area of land, insect pests have a perpetual food supply to hand, and although the first crop may be infested only slightly, later crops will probably suffer heavily.

By following one crop with some totally unrelated plant some types of insects can be completely checked. For instance, although cabbages may be severely attacked by cabbage moth, potatoes or carrots could be safely planted in the same plot later, whereas cauliflowers or brussels sprouts following cabbages would be liable to many cabbage pests. Again, tomatoes, cape gooseberries, and potatoes, have a common pest in the potato moth, and so do not make an altogether satisfactory rotation.

In controlling most pests it is essential to combine both cultural and chemical control measures, but careful attention to the former will greatly reduce the expense and labour involved in the latter.

Resistant Varieties.—The development and use of resistant varieties may perhaps be included under the heading of cultural methods. The principles of plant resistance have been exploited more efficiently in connection with certain plant diseases than with insect pests, but resistance is by no means unimportant in the latter field.

One of the most outstanding local applications of the principle relates to woolly aphis control on apple trees. This aphis attacks not only the twigs and branches but also the roots of apple trees, consequently when the aerial forms of the insect have been dealt with, re-infestation from the roots may occur. Certain types of apples, however, are unfavourable to the development of woolly aphis and these types are widely used as root stocks.

Amongst the best known of the resistant apple varieties may be mentioned the Northern Spy, the Winter Majetin and the Irish Peach, but the Northern Spy is the main root stock used in local orchards. Turning to vines we find the use of resistant stocks for Phylloxera is also a common practice in many countries. The insect is not established in Western Australia, but, in view of the possibility of its entrance, a reservoir of wild vine stocks is being

uilt up for immediate use should the eed arise.

In the case of vegetables, local examples f resistance are less spectacular than nose cited for fruit, but most readers will ave observed how seedling susceptibility aries with the particular pest. For instance, all types of peas are strong avourites with the red-legged earth mite, hereas onions receive little attention. his type of knowledge can often be put good use in choosing crops for particular tuations or seasons and of course can ave the grower considerable labour and xpense.

pests have become widely established on a continental land mass the chances of successfully introducing parasites are seriously limited. The new environment presents such a complex of factors, biotic, climatic and physiographic, that no single parasite or predator is likely to be of more than local significance. This does not mean that successes have not been achieved on large land masses, such as America and Australia, but in these instances the introductions have been made into areas which may be regarded as distinct ecological entities. South-Western Australia is generally recognised as an ecological island

n apple cut open to show he damage caused by the codling moth caterpillar

BIOLOGICAL CONTROL

No method of combating pests has ppealed so generally to the popular fancy s that usually known as biological conrol. This is readily understandable for it nvolves the use of one creature to subject nother and reduces to a minimum all nanual labour. Despite their wide appeal, he principles of biological control are by o means generally understood and the ery popularity of the method sometimes eads to the appearance of the most extravagant claims or unreasonable criticisms.

Many of the most outstanding successes with biological control have been achieved under insular conditions. The Hawaiian Islands probably offer the best examples, followed by Fiji and New Zealand. Where and possessing a warm equable climate and a certain degree of physiographic isolation it conforms with the main requirements necessary for the successful establishment of parasites.

The successful control of prickly pear in Queensland is perhaps the most outstanding example of successful biological control. This success has led to a widespread belief that every pest, insect or weed may be overcome by biological control methods if a sufficient search is made for parasites. There is no evidence whatever to support such a contention. Few insects or plants are free from the attack of natural enemies, but this does not mean that they are entirely controlled by such, or what is more important, that when an organism

is introduced into a completely new and favourable environment that such an environment will necessarily be favourable to the establishment of parasites and predators.

It is against introduced pests that biological control offers the most promise. Native insects have their own natural enemies, but when such insects assume pest proportions it is usually some particularly favourable alteration in the local environment rather than an absence of parasites which brings about the change. The little plague grasshopper of the dry wheatbelt for instance has assumed importance because of extensive clearing and the resultant appearance of vast breeding grounds and an abundant food supply. This grasshopper favours hard bare soil for egg-laying and feeds extensively on grass and cultivated cereals. When breeding areas were limited to roadsides and bush clearings, parasites and predators could keep down grasshopper numbers, but with extensive acreages of uncultivated grazing lands for egg beds the problem is entirely changed.

When investigating the possibility of controlling a pest by biological means, the following points must be considered:—

(1) Is the pest troublesome in its native home? If not, is it controlled there by natural enemies?

(2) Are all or any of the natural enemies established with the pest in its new environment? If not, can they be successfully introduced?

(3) Are the parasites and predators under consideration specific in their feeding habits or will they attack a variety of hosts?

(4) Is there any likelihood of any introduced parasite or predator proving troublesome in its new surroundings? (This is particularly important in the case of weed control, as parasites may attack not only weeds but closely related plants of commercial importance.)

It is only after these and various other points have been satisfactorily answered that any move can be made to undertake a programme of biological control and then the chances of outstanding success are by no means assured.

In Western Australia one of the mos outstanding achievements in the way o parasite introductions was the control o woolly aphis on apple trees by the was *Aphelinus mali.* Various other insects in cluding the green tomato bug, the whit cabbage butterfly and the cabbage moth are partly controlled by parasites, but i the field of weed control there is little t report. A leaf-eating beetle (*Chrysomel gemmellata*) has been established on St John's Wort in several districts in the lowe South-West with some localised success but generally the progress of the beetle ha been slow.

THE USE OF INSECTICIDES

When a plant is attacked the growe should observe how the insect feeds, a such knowledge will help materially i deciding what remedy to apply. Injuriou insects may be divided roughly into tw groups according to the nature of thei mouth parts viz:—(1) biting insects such as caterpillars and grasshoppers which bit and chew their food, and (2) sucking insects such as aphis, bugs, and scal insects which imbibe the plant sap b means of a beak or proboscis.

The manner and time of applying insecticides has almost as much effect upon th degree of control obtained as the kind o insecticide used.

At the very first sign of trouble a thorough treatment should be given, fo many insects multiply so rapidly that onc they have become firmly established much damage can be done before they can b brought under control.

The necessity for prompt action is particularly urgent in seed beds for a dirty seed box may result in the infestation o the entire crop when planted out.

Many wise gardeners take the precautio of dipping or washing their seedlings i Black Leaf 40 or some other insecticide just prior to planting out, so as to ensure a clean start in the field.

In applying dusts and sprays as complete a cover of the foliage as possible should be aimed at, not forgetting the under surface of the leaves, for many insects prefer to feed in this more sheltered situation. Calm fine weather should be chosen whenever possible, as wind is liable to cause much waste of material, and, of course, a

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shower just after treatment is liable to nullify all the good work.

Dusts are often applied with a special dust gun or blower, but such equipment is not necessary for a backyard garden. The material can be placed in a bag or some other cloth container of suitable texture, and the dust shaken on to the plants through meshes of the bag.

Practically any type of spray pump can be used for applying poison sprays. In the case of contact sprays, however, care must be taken to see that the liquid is applied with considerable force, for insects sheltering beneath the foliage must be reached, and the actual force with which they are hit will influence the degree of control obtained.

Dusting with D.D.T. powder by means of a wheelbarrow duster

In the case of insecticides, either dusts or liquids, containing nicotine the best results will be obtained during warm fine weather, for the nicotine fumes are liberated slowly on a cold cloudy day.

It has been the practice to add soap or white oil to nicotine sulphate as spreading and wetting agents. In recent years a large number of detergents have become available and certain of these ("Teepol," "Comprox," "Lissapol," etc.), are highly efficient substitutes for the other materials.

Before leaving the general question of contact insecticides, it may be helpful to know in what way they affect the insect. In some instances toxic elements are actually absorbed through the body wall of the creature. Nicotine depends to a large extent upon its fumigatory action; but soap and oil sprays interfere with the breathing operations of the animal. An insect, it should be remembered, does not breathe by means of a nose and lungs as do the higher animals, but by means of a system of ramifying tubes which open to the surface as a series of holes or breathing pores along either side of the insect's body. If these holes are clogged by a spray film, death from suffocation is the result.

With the introduction of insecticides such as DDT, parathion, etc., the approach to insect control has changed to some degree. These types of insecticides known collectively as organic insecticides may affect insects in three ways, by contact and subsequent absorption through the cuticle, by ingestion (as a stomach poison) and by fumigation, so that sap sucking and chewing insects can both be controlled with the same material. However, many of these insecticides are quite specific, and although one will kill a particular species, a closely related species may not be affected. A good example of this is to be found in red-legged mite and red spider. The former is killed by DDT, but the latter may even increase following a DDT application because parasites and predators of this mite have been killed.

THE OLDER INSECTICIDES

The materials included under this heading have to a great extent been replaced by more efficient substitutes, but some still have very definite uses. For instance, lime-sulphur, nicotine (as nicotine sulphate or tobacco dust), pyrethrum and rotenone (derris) are effective against a range of insects and can be used on edible portions of plants shortly before harvesting. This may be due to either the low toxicity hazard as regards humans (e.g., pyrethrum and rotenne) or because of the rapid break down (e.g., nicotine sulphate.)

THE NEWER INSECTICIDES

These materials have been grouped into four main sections according to their general chemical nature.

1.—CHLORINATED HYDROCARBONS

DDT is the most widely known and used of the newer insecticides. It is effective against an extensive range of pests and is certainly one of the most useful insecticides for the vegetable gardener to have on hand. Although poisonous to man it is comparatively safe to use. It remains effective on the plant for a reasonable period and does not normally taint or otherwise spoil the crop. Practically all leaf-eating insects and many sap-sucking pests are highly susceptible to DDT, notable exceptions being the lucerne flea and the red spider.

B.H.C. (Benzene hexachloride) is effective against a fairly wide range of pests, and although toxic to humans is much less dangerous to the user than aldrin or dieldrin. The unpleasant odour which has largely prevented its use on edible crops has been overcome by the production of the purified form known as **LINDANE.** B.H.C. has been widely used in baits against grasshoppers and cutworms and as a ground dressing against root maggot flies and similar soil-infesting insects, besides being often combined with DDT, as a general garden insecticide.

Aldrin, dieldrin, endrin and isodrin are compounds very closely linked in nature and action. They have considerable lasting effect and dieldrin incorporated in the ground has remained effective against white ants for up to five years. They are all fairly toxic materials and thus form a considerable hazard to the applicator and consumer. Their main uses in the vegetable garden are in soil dressings against wire worm, etc., and as barrier sprays against such insects as grasshoppers and ants.

T.D.E. (DDT) and methoxychlor are very closely related to DDT. They are effective against a restricted range of insects including flies and leaf-rolling and webbing caterpillars. Both are considerably less toxic to humans than DDT and this renders them relatively safe.

2.—ORGANIC PHOSPHATES

Parathion, despite its dangerous nature, is one of the best known and most widely used of this group. Known under such trade names as "Folidol," "Phosphone," etc., it is used against a wide range of pests. It is highly effective against aphids and other insects, for which nicotine sulphate was previously used, and will kill most leaf-eating pests. It finds its most important use in the vegetable garden against insects which are not highly susceptible to DDT, including lucerne flea, red spider and the adult form of a number of sap-sucking bugs. It is extremely dangerous material to use and less toxic substitutes should be applied whenever possible.

Malathion is considerably less toxic to humans than parathion and, at slightly higher concentrations than parathion, is effective against a comparable range of pests. It is now extensively used for home garden purposes and for the control of fruit fly and lucerne flea.

H.E.T.P. and **T.E.P.P.,** known under such trade names as "Hexone" and "Hetraphos," are related compounds of an extremely dangerous nature. They are however, very rapidly broken down when exposed, and thus form a much greater hazard to the gardener than to the consumer. The former is extremely effective against aphis and red spider.

Gusathion (Guthion). This material has been used very effectively against San Jose scale and Citrus Red scale and has shown promise against caterpillars and various other insects and mites. It is somewhat less toxic than Parathion but should be used with considerable care.

Trithion. This is comparable to Gusathion in its mammalian toxicity and has been found particularly effective against various fruit tree mites.

Dipterex is one of the less dangerous organic phosphates and has been used with very good results for the control of fruit flies and house flies. The material is absorbed into the flesh of the ripening fruits and kills developing eggs and maggots.

Rogor 40 and Lebaycid have comparable properties to Dipterex and give indications of being superior to the latter for the control of fruit fly. Lebaycid is highly toxic to poultry and other birds but is less dangerous to mammals.

3.—SYSTEMICS

Systemics are so named because of their mode of action which is through the vascular system or sap-stream of the plant. These materials can be applied either to

Spraying orchard trees with a tractor-drawn outfit operated by a power take-off

the soil or to the foliage, from where they are absorbed into the plant and transported through the conducting vessels. Insects feeding on the sap are rapidly killed. This technique of insect control does not affect the natural enemies of the pest but owing to the residual action of the systemics and the extreme toxicity of some types, these materials should be used with care and in strict accordance with manufacturer's recommendations. Amongst the systemic insecticides available locally may be listed Metasystox and various modifications thereof, Ekatin, Sayfos and Thimet. Some of these preparations have shown considerable promise as seed dressings for the control of red-legged earth mite and lucerne flea.

4.—CARBAMATES

Sevin. This material is a carbamate and is related to some of the fungicides. It is one of the safer materials from the standpoint of mammalian toxicity and has been used effectively for the control of various types of caterpillars, particularly those resistant to the chlorinated hydrocarbons.

5.—THIODAN

This is a hetero cyclic sulphur compound quite poisonous to warm blooded animals. Locally it has been used effectively for the control of earth worms in lawns and is reported to have a use for the control for aphis and certain weevils. Both Sevin and Thiodan are important as being two new types of insecticides which may be employed against insects which have developed resistance to both the chlorinated hydrocarbons and the phosphates.

6.—MITICIDES

Various types of chemicals have been developed recently, especially for the control of mites and "spiders." Ovotran or PCPPCBS ("Ovamite," "Mitran," "Ovobane," etc.), PCPBS ("Elimite"), Aramite and Chlorparacide are amongst the most common. The action of these materials is mainly against the eggs of the mites so that there is no spectacular kill of adults and more than one application is usually necessary.

EFFECT ON CONSUMER

Because of the long-lasting effect of many insecticides it is extremely dangerous

to apply them to edible portions of the crop immediately prior to harvesting. The following table sets out the approximate period which should elapse after application and before harvesting.

——	Sprays	Dusts
Aldrin, Arsenate of Lead, Dieldrin, Endrin, Isodrin, Chlordane	4 weeks	4 weeks
DDT, BHC, and Lindane, Parathion, TDE	4 weeks	4 weeks
Malathion, Methoxychlor, HETP and TEPP....	2 weeks	4 weeks

The above periods are a minimum and should be extended if concentrations or quantities are used which are above those normally recommended for application to foliage.

Growers should note that the important consideration is the presence or absence of undesirable residues on the edible portions of the plant. The presence of such residues may cause rejection from the market besides creating a hazard for those eating the vegetables.

PLANT INJURY

Although most of the insecticides mentioned can be used against pests on practically all plants without damage, the following table sets out the main ones on which injury may occur. Care should always be exercised in applying insecticides to the more delicate foliage particularly during hot, dry weather. It is well to remember also that damage may be caused by the particular solvent in which the insecticide is formulated and so different preparations of the same insecticide may vary in their effect on plants. Combinations of insecticides may also cause damage whereas the materials when used by themselves may be quite safe.

Before mixing different types of insecticides or combining insecticides and fungicides the accompanying compatibility chart should be consulted.

Because of the many varying factors which may contribute to plant damage the following table is not intended to be all-inclusive but only to indicate types of damage which have been recorded and which may occur again. It must also be pointed out that although damage has been recorded it does not necessarily exclude the use of the insecticides on the plants listed.

It is advisable when trying out any new preparation to use it first on a few plants. Concentrations recommended should be strictly adhered to.

Insecticide	Plant	Possible Damage
DDT	Melons, Cucumbers, etc.	Chlorosis and Foliage Burning
DDT	Bean and Tomato seedlings	Dwarfing and Distortion
BHC heavy soil dressing	Various Seedlings	Dwarfing and Distortion
BHC	Various	Tainting and off flavour
Parathion and HETP	Tomatoes	Distortion of foliage and fruit
Parathion	Various	Slight off flavour

DISEASES

The use of chemicals for the treatment of fruits and vegetables involves certain hazards both to the user and to the consumer on account of possible toxic residues. This has led to careful investigations into the use of insect diseases and certain virus organisms and bacteria have been found to show promise. A bacterial infection known as *Bacillus thuringiensis* has been prepared for commercial use but so far has only been used experimentally in Australia.

RESISTANCE

When first introduced for the control of flies and mosquitoes, DDT was hailed as the wonder insecticide and many people prophesied the complete elimination of several of our major pests. It soon became apparent however, that larger and larger doses of insecticide were necessary to get results and that in some instances quite high rates of application were virtually useless. Although for some time flies and mosquitoes seemed to be the only insects showing any important resistance tendencies, the list gradually began to grow and it has now reached quite alarming proportions. Amongst the creatures already known to be resistant to DDT can be mentioned codling moth, cockroaches, bed bugs, lice and ticks.

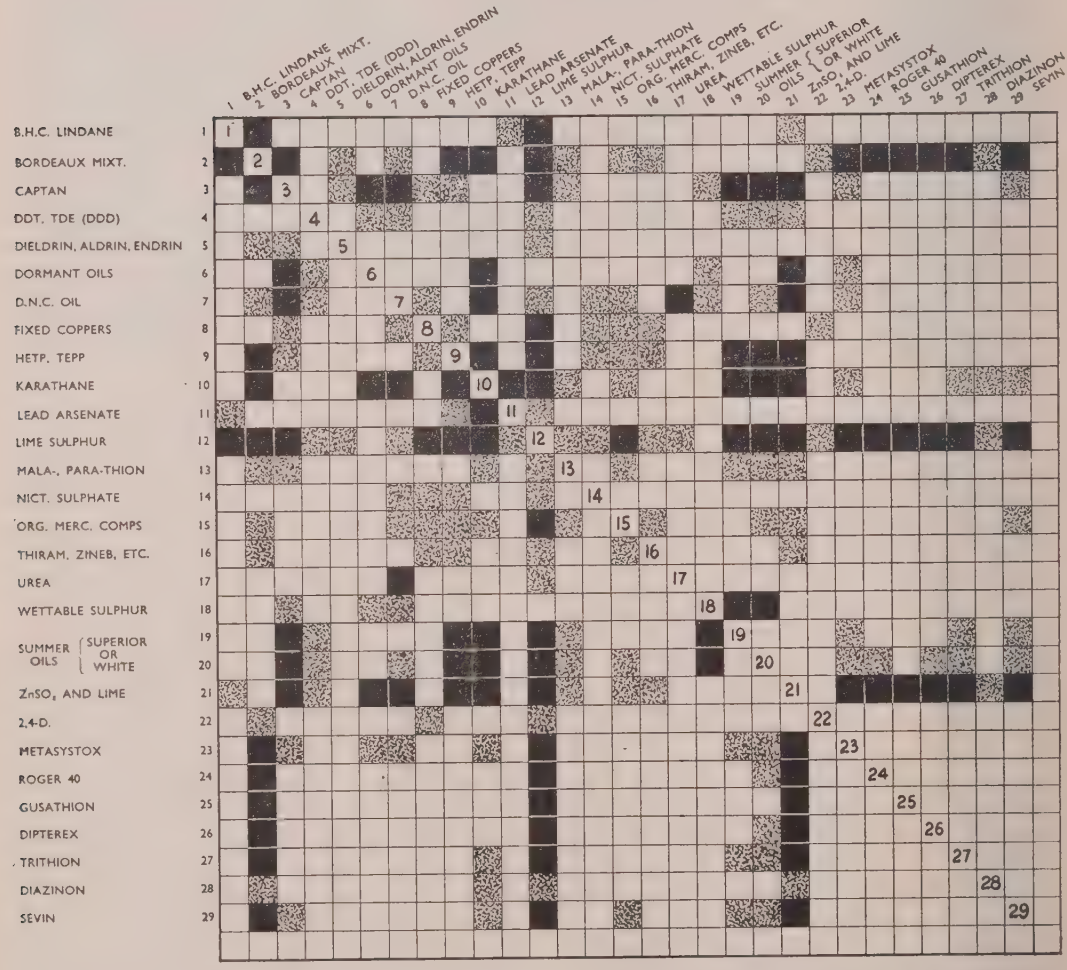
Unfortunately the development of resistance to one insecticide may predispose

some insects to develop rapid resistance to other chemicals and so further complicate the problem of control. Insect resistance to chemicals is not really a new phenomenon. In the early 1900's various scale insects were known to be showing more and more tolerance to the lime sulphur sprays and cyanide fumigation. About 1928 certain strains of Codling moth were shown to be resistant to arsenate of lead and with the passing of time, more and more insects have become more and more resistant to an ever-increasing list of chemicals.

Fortunately resistance to insecticides generally shows up first in small areas so

WESTERN AUSTRALIAN DEPARTMENT OF AGRICULTURE

COMPATIBILITY CHART



KEY—

Not compatible. Should be applied separately, in most cases with long intervals between applications.

Questionable compatibility. Mixtures must be used with caution and are not recommended.

Fully compatible, and may be mixed together for application.

NOTE—*If the need arises to use materials not included in this chart, growers are advised to contact the Department of Agriculture.*

The chart applies only to two-material spray combinations. Where three or more materials are mixed together, further incompatibilities may occur.

If the recommended concentrations are exceeded, further incompatibilities may occur.

Incompatibility may be due to—

(1) *Reduced effectiveness of one or both materials.*

(2) *Plant damage resulting from the combinations of two materials which would not occur if either material was used separately.*

(3) *Curds or precipitate resulting from the combination of two materials causing nozzles to be clogged or failure of the spray to disperse properly.*

that there is time to make appropriate adjustments in the control programme. Also many new insecticides are being produced and these can be expected at least temporarily to relieve the situation and to give scientists more time to grapple with the problem.

A complete solution to the resistance problem is not yet in sight but there are various ways in which an emergency can be met. To lessen the opportunity for the development of resistance, insecticide treatments must be carefully timed and applied to give maximum results and only the most effective chemicals for the job in hand should be chosen. When resistance has been definitely proved another unrelated type of chemical may be used before the existence of resistance is definitely accepted, the possibility of faulty application or some other similar factor should not be overlooked.

EFFECT ON BEES AND OTHER USEFUL INSECTS

DDT, dieldrin, etc., are known to be toxic to bees as well as many other useful insects, but the same applies to many insecticides and this is not a sufficient reason for condemning the use of new materials. Bees are most vulnerable when blossoming plants are treated, and usually dust and spray applications can be timed to avoid the blooming period.

In addition, it is of interest to note that in Germany field dustings with DDT and arsenate of lead have shown that bees could withstand treatments at three times the necessary strength of DDT required to control rape beetle, but were killed with the minimum application of arsenate of lead.

If bee-hives are present near an area to be sprayed and removal is not possible. a supply of drinking water should be made available close to the hives to reduce the chance of bees imbibing poisoned droplets from the sprayed foliage.

It is doubtful whether the various pessimistic forecasts concerning the adverse effect of DDT upon the balance of nature are well founded. Local upsets may occur, as has been instanced earlier in this article when mention was made of the possibility of red spider outbreaks increasing after the liberal use of DDT to control other pests. Dual-purpose and alternative mixtures are being developed to meet such difficulties, however, and there is no reason to consider the problems insoluble. There is nothing to recommend the wholesale and indiscriminate dispersal of DDT over the country side to kill friend and foe alike, but on comparatively small areas, such as orchards, gardens and farms the effects would be local and should be easily adjustable by future action.

The above comments have been applied specifically to DDT, but they apply equally to the other potent and residual insecticides. All should be used with discretion and at the minimum concentration necessary for the particular pest which it is desired to control.

In view of the rapidly-changing scene on the insecticide front, it has been necessary to deal in rather general terms with the materials so briefly reviewed in the last few pages. Fresh information is being continually published in all parts of the world and readers wishing further information on a particular problem are advised to communicate with the Department of Agriculture for any more recent developments.

GENERAL WARNING AND PRECAUTIONS

Comments concerning the toxicity of the various insecticides to man and domestic animals and the possibility of heavy residues occurring on treated plants have been made under the heading of the particular insecticides. Materials mentioned in this section however, are listed below in approximate order of toxicity and grouped together according to the hazards associated with their use.

HETP and TEPP, Parathion, most systemics—very dangerous.

Arsenate of lead, Endrin, Isodrin, Dieldrin, Aldrin, Nicotine Sulphate —dangerous.

Chlordane, BHC (including Lindane), DDT—needs careful handling.

Malathion, TDE, Methoxychlor, Pyrethrum, Miticides — comparatively safe to use.

Practically all of the newer insecticides are toxic if the fumes are breathed, if they are swallowed, or if the concentrate comes into contact with the skin. This is more particularly the case with the organic

phosphates and as such every care should be taken in handling these materials.

Briefly the precautions which should be taken are:—

(1) Read the safety directions and instructions on the container before opening.

(2) Operators should not eat or smoke while handling insecticides.

(3) Protect hands and arms by using barrier cream. It assists in preventing penetrations through the skin.

(4) When measuring concentrates, avoid splashing, wear rubber gloves and avoid inhaling fumes.

(5) When spraying avoid spray rebound or wind-borne mist.

(6) No part of the body should be unnecessarily exposed. Overalls or long trousers and a shirt should be worn.

(7) Wash off thoroughly with soap and water any spillage on the skin, and when spraying is completed remove any wet clothes for laundering and wash thoroughly. Where parathion, HETP, etc., are being used for more than a very short time, full protective clothing and face mask should be worn.

"FAILURES OF FLOOR SURFACING MATERIALS ON CONCRETE SLABS" DIVISION OF BUILDING RESEARCH C.S.I.R.O. BUILDING STUDY No. 2

Concrete slab floors poured directly on the ground are becoming increasingly popular for shops, offices and dwellings. However, in common with all new trends and new materials, their adoption inevitably introduces new problems, among which failures of floor surfacing materials are probably the most serious.

Although these failures are variously described (bubbling or blistering of sheet materials, curling or cupping of tiles, etc.), it has been found that the basic trouble is loss of adhesion between the surfacing material and the slab. With very few exceptions, this has been due to the presence of water.

The causes and prevention of dampness are dealt with in Building Study No. 2 —"Failures of Floor Surfacing Materials on Concrete Floors"—issued by the Division of Building Research of the C.S.I.R.O. These are briefly referred to below.

The Causes of Dampness.—There are three ways in which moisture can reach the top of the slab:

Residual Water.—The greater part of the water used to mix concrete evaporates as fast as it reaches the surface. If complete evaporation has not taken place before laying a floor covering over the slab, moisture will accumulate at the junction of the slab and the surfacing material.

Capillary Water.—Dry concrete on soil subject to wetting will readily absorb enough water to cause dampness to reach the top of the slab.

Water Vapour.—At night and during the winter, the surface of the slab will be colder than the soil beneath it. This will cause migration of water vapour through the permeable concrete with resultant condensation on the upper surface.

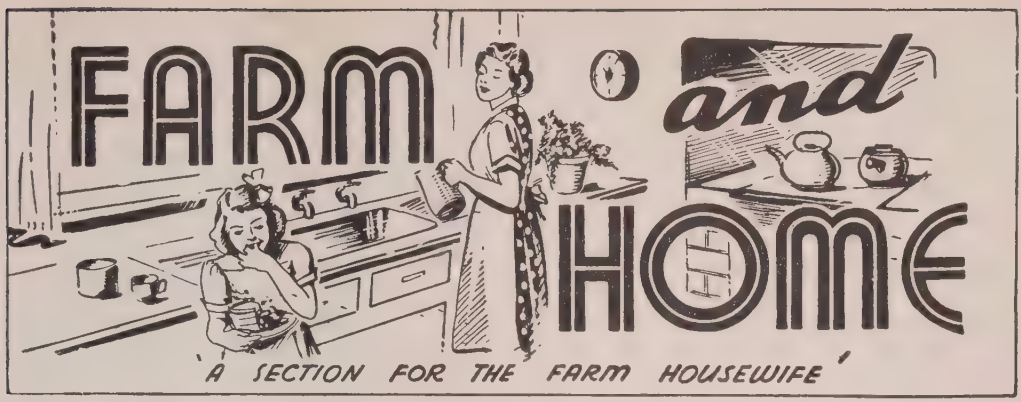
Recommended Measures to Prevent Moisture Troubles.—Water will cause deterioration of the adhesive or actual decay of the floor covering. Means for preventing this are set down below.

To cope with *capillary water* tarred screenings should be used under the slab; also provision must be made to protect the exposed edges of the slab.

To prevent *water vapour* rising through a slab, a water vapour barrier should be placed either under the slab or in the slab as a sandwich, and connected continuously with the wall dampcourse. Suitable types are mentioned in the Study.

To allow *residual moisture* to completely evaporate, floor coverings should be not laid for at least four months. Tests have shown that under cool, well ventilated conditions, a slab drying out from one face only will take about one month per inch of thickness to dry out.

Building Study No. 2 may be obtained free on application to the Building Research Liaison Service, P.O. Box 2807AA, Melbourne; or to the Chief of Division, C.S.I.R.O. Division of Building Research, Graham Road, Highett S.21, Victoria. A 5d. stamp to cover postage should accompany mail orders.



SUGAR BAGS—JUST SUGAR BAGS!

By HELEN M. GLOSTER

DID you all buy bags of sugar and make jam, and bottle fruit, while the soft fruits were in season?

I do hope you saved those sugar bags—also the bits and pieces of gay drip-dry cottons left over from home dressmaking.

You will find there are plenty of useful and attractive articles that you can make with these things.

Preparation of canvas (hessian).

Unpick the sugar bags. The thread will come away in one length. It is strong and may be saved for making blue bag covers in crochet.

Wash the bag in plenty of warm soapy water, rinse, dry and iron.

A KITCHEN TIDY

The tidy is made to fasten on the inside of the kitchen door. It is used to hold paper and string.

Requirements.

A sugar bag (this will make two.)

2 strips of floral drip-dry cotton 18in. x 2 in.

3 strips of floral drip-dry cotton 17 in. x 1½ in.

2 strips of floral drip-dry cotton 4 in x 2 in.

Scrap of coloured knitting wool.

Method.

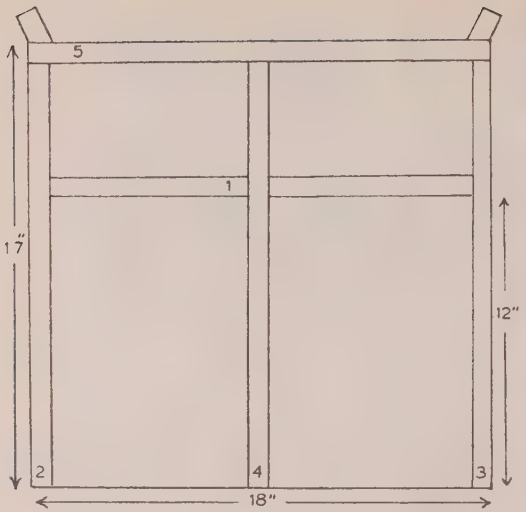
1. Cut the bag in two lengthways to get a piece of canvas 18 in. x 30 in.

2. Face one end with an 18 in. x 2 in. strip. This should measure about 1½ in. when finished.

3. Fold this end to make a pocket 12 in. deep with facing to the right side, at the top of pocket.

4. Put facings down the two sides and another strip down the centre using 17 in. x 1½ in. strips (1 in. when finished).

5. Make loops for hanging from 4 in. x 2 in pieces. Fold in two lengthways, turn in edges and topsew together.



Measurements and order of sewing on facings of kitchen tidy.

6. Machine the last facing on the top, inserting the loops before the first row of machining.

7. Work the words "Paper" "String" across pockets in chain stitch, using wool.

8. Top sew ends of facings by hand when neatening the tidy.

PEG APRONS

Mother and Daughter Set

One sugar bag will make an apron for an adult and a small apron for the pre-school daughter.

A four year old girl would be delighted to help mother with hanging out the cloths if she was presented with this attractive apron, a replica of mother's apron.

Incidentally these are good selling lines at fetes.

Requirements.

1 sugar bag.

About 12 in. length 40 in. drip-dry cotton for large apron.

About 9 in. length 40 in. drip-dry cotton for child's apron.

4 coloured clip-on plastic pegs.

Adult Apron—Method.

1. Cut a strip of Canvas 30 in. x 24 in.
2. Cut drip-dry as follows:—

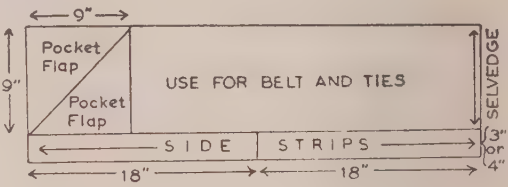
   A 9 in square cut diagonally for 2 pocket flaps.

   2 strips 18 in. x 3 in. or 4in.

1 strip 48 in. x 4½ in. (this may have to be joined) for waist band and ties.

How to Cut Cotton.

N.B.—If using up scraps the waist band and ties are stronger if cut running the length of the selvedge.



3. Face corners of canvas at one end with three cornered pieces of cotton material.

4. Turn back corners so that facing is on the right side.

5. Double canvas, with facing still uppermost.

6. Join sides with coloured strips, finishing on the right side.

7. Make a 1 in. pleat at the top of apron about 5 in. from each faced edge.

Pleats should face towards the centre.

8. Join waist band and ties in one long strip (about 48 in.).

9. Pin centre of band to centre of apron, right sides together.

10. Tack band to apron, then machine along tacking.

11. Machine ties on the double, right sides together, turn so that raw edges are inside.

12. Topsew ends and neaten the wrong side of waist band by joining to waist with hand hemming.

13. Neaten ends of facings with top sewing.

14. Attach a peg to each pocket flap.

Child's Apron—Method.

1. Cut a strip of canvas 21 in. x 12 in.
2. Cut drip-dry cotton as follows:—

A 6 in. square cut diagonally for 2 pocket flaps.
2 strips 10½ in x 3 in. for side facings.
1 strip 40 in x 3 in. for waist band and ties.

3. Make up in a similar manner to adult apron.

N.B.—Give a little extra width to the apron by attaching side strips as bands instead of facings in a similar fashion to waist bands.

BRUNCH BUNS

Try these some time when you wish to fill a biscuit tin to have something in the way of a stand-by. These buns keep well in an air-tight tin and are suitable for serving at morning tea, afternoon tea or supper.

Ingredients.

4 oz butter or shortening.
½ cup raw sugar.
1 egg.
½ cup desiccated coconut.
½ teaspoon vanilla essence.
1 cup mixed fruit and nuts—(dates raisins, cherries, preserved ginger and almonds).
1 cup self-raising flour.
Finely crushed cornflakes.

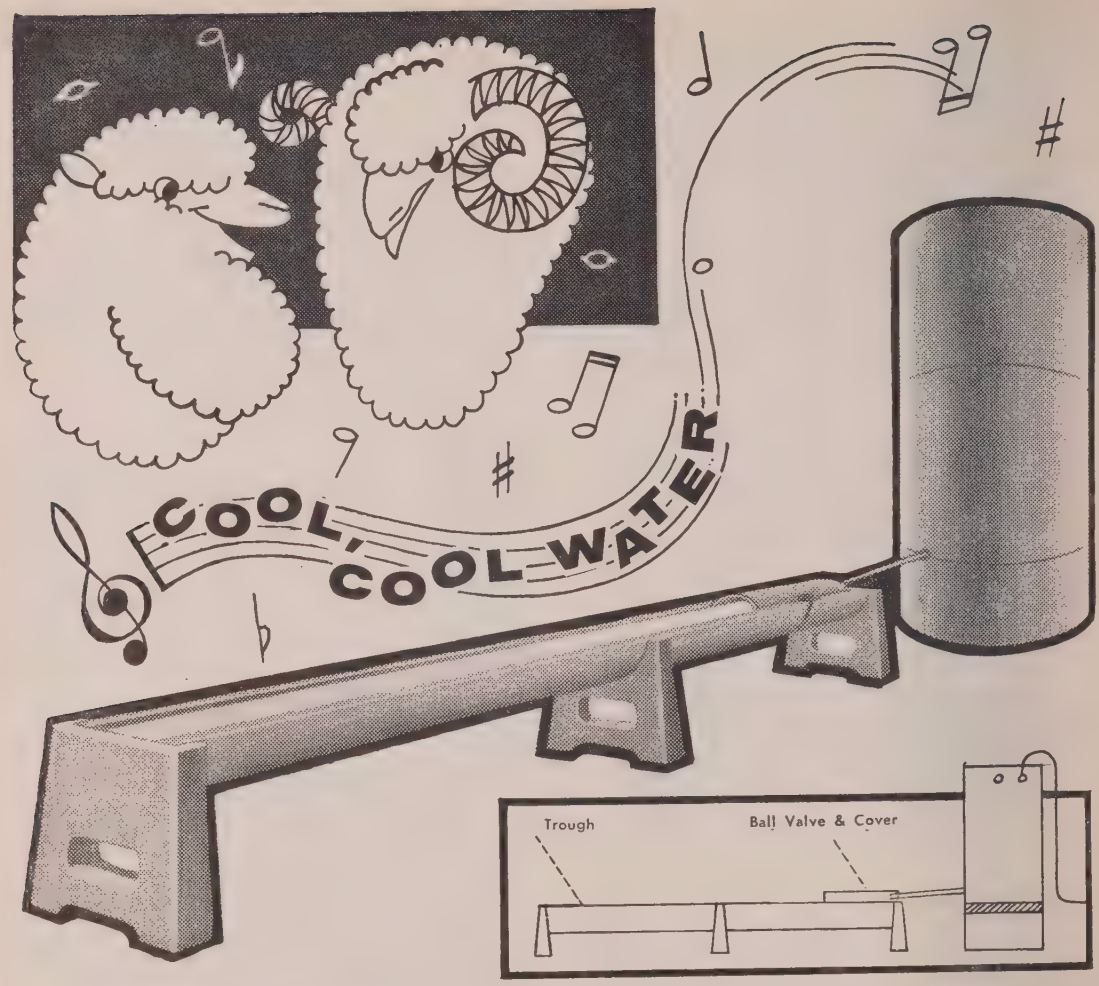
Method.

1. Seed raisins, chop fruit and nuts, mix all together.
2. Cream butter and sugar until grain disappears from sugar; add vanilla.
3. Add beaten egg, beat well.
4. Mix in prepared fruit and nuts.
5. Stir in sifted flour.
6. Take a teaspoon of mixture at a time, form into a ball and roll in crushed cornflakes.
7. Place balls on a greased oven slide.
8. Bake in a moderate oven until cooked and a golden brown (about 15 minutes). Oven temperature 350° F.
9. Allow to cool on oven slide.

N.B.—For coating these biscuits with cornflake crumbs, place crumbs in a small plastic or brown paper bag.

Place a few balls of mixture in bag and shake.

Lift balls out one at a time and roll lightly between palms of hands before placing on oven slide.



This simply constructed water cooler for stock troughs speeds the watering of sheep. With this method, the sheep have their drink and very quickly clear the trough — they don't mess around for an hour or more. The cooling tank is made of 43" diameter Humes well lining pipes and holds sufficient water for 500 sheep for one day.

When the sheep drink from the trough, cool, cool water is replaced from the the tank. Write or ask Humes Ltd., for full details.

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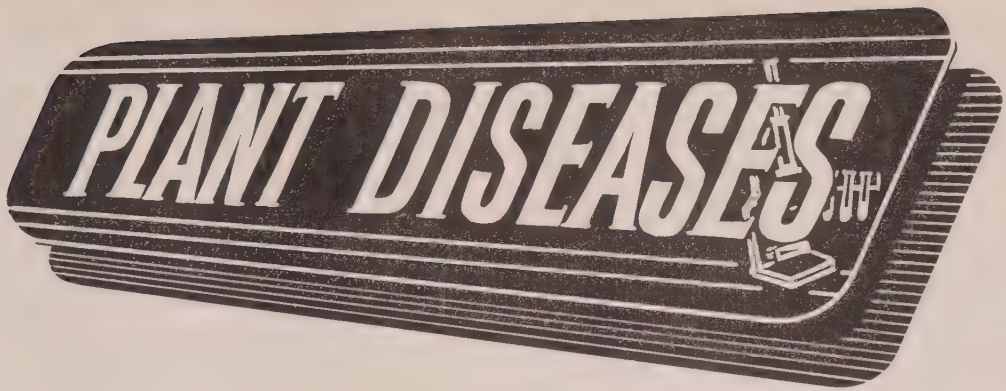

Bare Patch and Poor Emergence of Cereals

FACTORS UNDER INVESTIGATION

1.—Seed Treatment and Moisture Content

By S. C. CHAMBERS, M.Sc., Plant Pathologist

UNDER the relatively dry climatic conditions of Western Australia, over-dosages of organic mercury dusts had no apparent ill-effects upon wheat emergence, irrespective of the initial moisture content of the seed. However, seedling counts were significantly less, with seed of a high moisture content.

An emergence problem known locally as "Bare Patch" has become increasingly prevalent in cereal crops during recent years. Although pathogenic fungi are often responsible for the condition, current investigations have shown that it may also be caused by several other factors.

In some instances involving pathogenic fungi, Cass Smith[2] reported better establishment of wheat seedlings following the use of an organic mercury seed dust. As the same compound also gives effective control of covered smut,[1] dusting seed with an organic mercury fungicide is now the general Departmental recommendation. Usually the grain is pickled in the field during December or January by contractors at the rate of 1½-2 oz./bushel, and then is stored until sown in the following autumn.

In 1959, a report was received from a grower complaining of poor emergence which he attributed to an overdosage of an organic mercury seed dust. As detrimental effects on germination by overdosages have been reported from New Zealand[4] and Germany,[3] it was decided to determine experimentally the effects of high dosages under W.A. conditions.

Experimental:

In February 1960, grain samples were obtained of the following two wheat varieties:—

(1) The hard grained "Gabo" with a natural moisture content of 9.1 per cent.

(2) The soft grained "Insignia 49" with a natural moisture content of 10.7 per cent.

As overseas reports suggest grain with a high moisture content is more liable to fungicidal injury, the moisture content of half of each sample was increased to 16 per cent.

One hundred gram aliquots of grain were then dusted with various dosages of ceresan to give the 32 treatments listed in Table 1. A mixture of ceresan and fernasan (TMTD) was also included because of its current recommendation in New Zealand.[5]

TABLE 1

Seed Treatments Evaluated in Experimental Plots at South Perth

Variety	Type	Initial moisture content	Dosages of Seed Dressing (oz./bushel) with Ceresan only							Ceresan + Fernasan
			0	1	1½	2	3	4	5	1 + 1
		%								
Gabo	Hard	9·1	1	2	3	4	5	6	7	8
„	„	16·0	9	10	11	12	13	14	15	16
Insignia 49	Soft	10·7	17	18	19	20	21	22	23	24
„	„	16·0	25	26	27	28	29	30	31	32

After dusting, no attempt was made to maintain the moisture levels of the samples which were stored in large jars for 16 weeks. The seed was sown during the last week of May in the coarse sandy type of soil, which is so characteristic of the Perth environs.

The experimental design for the test plots was a simple randomised system containing 10 replications of the 32 treatments. Each component plot contained 100 seeds planted at a depth of 1 inch in 10 rows of 10, with a space interval of 1 inch between each seed.

Emergence counts were taken four weeks after sowing and analyses of these results are contained in Tables 2 and 3. Seedlings were apparently normal and there was no evidence of any seedlings being adversely affected by the fungicidal materials.

DISCUSSION

It is evident from the results (Table 2) that overdosages of ceresan have not significantly affected the emergence of either the hard grained "Gabo" or the soft grained "Insignia 49."

Reports from Smith and Blair[4] (New Zealand) and Frohberger[3] (Germany) link the deleterious effects of organic mercury dusts with a high moisture content of the grain. However, the moisture content of wheat seed is higher in these countries than here. For example, these workers in New Zealand and Germany used grain with a natural moisture content of 13.7 per cent and 16.8 per cent. respectively, whereas in Western Australia the value is normally 9 or 10 per cent.

From the results (Table 2) it is also apparent that increasing the moisture content to 16 per cent. has not sensitised the grain to ceresan injury. However, as no attempt was made to maintain the initially high level, it is believed the hot dry weather of February quickly reduced it again.

In the opinion of Smith and Blair[4], a high moisture content at harvest and during storage is sufficient in itself, to

TABLE 2

Emergence Counts of Wheat Seedlings in relation to Seed Treatment

(a) Variety Gabo

Dosage of Ceresan	Percentage emergence of wheat with an initial moisture content of		Data transformed (Arcsin √per cent. emergence)	
	9·1%	16·0%	M.C. 9·1%	M.C. 16·0%
oz./bushel	%	%	%	%
0	90·5	87·7	72·2	69·4
1	93·5	90·1	75·2	71·7
1½	93·4	91·3	75·1	72·8
2	92·3	90·4	73·9	71·9
3	93·1	89·3	74·8	70·9
4	94·9	90·5	76·9	72·1
5	93·7	89·2	75·4	70·8
1 + 1 oz. Fernasan	91·6	90·5	73·2	72·0
Difference for significance P = 0·05			3·3	3·3

TABLE 2

Emergence Counts of Wheat Seedlings in relation to Seed Treatment

(b) Variety Insignia 49

Dosage of Ceresan	Percentage emergence of wheat with an initial moisture content of		Data transformed (Arcsin √per cent. emergence)	
	10·7%	16·0%	M.C. 10·7%	M.C. 16·0%
oz./bushel	%	%	%	%
0	97·2	95·1	80·4	77·2
1	97·4	96·0	80·6	78·4
1½	96·8	95·8	79·7	78·1
2	96·6	93·7	79·3	75·4
3	98·2	93·5	82·3	75·2
4	97·2	95·4	80·4	77·6
5	98·1	93·5	82·0	75·2
1 + 1 oz. Fernasan	95·6	95·3	77·0	77·5
Difference for significance P = 0·05			3·3	3·3

TABLE 3

Emergence Counts in Relation to Moisture Content of Seed

Initial moisture content of Grain			Percentage Emergence		Data Transformed (Arcsin √per cent. emergence)	
	Gabo	Insignia 49	Gabo	Insignia 49	Gabo	Insignia 49
	%	%	%	%	%	%
Low	9·1	10·7	93·0	97·2	74·61	80·34
High	16·0	16·0	89·0	94·8	71·46	76·84
Differences for significance			P = 0·05		0·70	0·70
			P = 0·01		0·92	0·92

cause a reduction in seed viability. From the results (Table 3) it is evident that seedling emergence was significantly reduced by using seed in which the moisture content was increased temporarily. During thunderstorms, much the same effect occurs to grain nearing maturity, and it is possible the viability of such seed may also be reduced significantly. Grain maturing under these conditions is characterised by the copious development of secondary black moulds on all parts of the head.

REFERENCES

[1] Cass Smith, W. P. (1952)—J. Agric. W. Aust. Series 3, 3, 3, pp. 329-338.

[2] Cass Smith, W. P. (1959)—Farmer's Weekly 12, 316, p. 2.

[3] Frohberger, P. E. (1958)—Höfchenbr Bayer Pf; Sch. Nachr, Eng., Ed. 11, 3, pp. 103-114.

[4] Smith, H. C., and Blair, I. D. (1959)—N.Z. Wheat Review 1956-58, pp. 64-70.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to officers of the Wheat Division for determinations of and adjustments to the moisture contents of grain, Mr. L. Price for assistance with the field work and Mr. M. Thornett for statistical analyses of results.

BORDEAUX MIXTURE

By the PLANT PATHOLOGY BRANCH

BORDEAUX mixture is still proving a most effective spray against many serious plant diseases in this State despite the increasing use of the newer organic fungicides. When properly made and applied it adheres to the plants with great tenacity and strongly resists the weathering action by rain.

Amongst the diseases controlled by Bordeaux mixture are Brown Rot *(Phytophthora hibernalis* and *P. citrophthora)* of citrus, Shot Hole *(Clasterosporium carpophilum)* and Leaf Curl *(Taphrina deformans)* of stone fruit, Leaf Spot *(Septoria apii)* of celery, Brown Spot *(Alternaria passiflorae)* of passion vine and Bacterial Blight *(Pseudomonas juglandis)* of walnut.

COMPOSITION

The fungicide is a light blue gelatinous precipitate containing copper in a complex form and obtained by mixing together bluestone (copper sulphate) solution and a suspension of quick lime slaked in water.

The strength of the mixture is shown by use of a standard formula, written for example 4 : 4 : 50. The first figure states the amount of bluestone (copper sulphate) in pounds, the second figure the amount of quick or freshly burnt lime (calcium oxide) in pounds and the third figure the quantity of water in gallons in the mixture. Fresh hydrated lime can be substituted for quick lime in the formula but must be used at the rate of 1½ times the amount of quick lime. Bordeaux mixture may be applied at different strengths depending on the nature of the plant and the disease. Other formulae commonly used include 6 : 4 : 40 and 4 : 4 : 40.

PREPARATION

The following method is outlined for use by commercial growers and involves the preparation of a large spray vat of the fungicide.

To make 50 gallons of Bordeaux mixture at 4 : 4 : 50 strength:—

(a) Dissolve 4 lb. of finely powdered bluestone in 45 gallons of water (nine tenths of the total volume) in the spray tank. The bluestone can conveniently be dissolved by washing it through the strainer with a stream of water. As bluestone is corrosive, it is assumed that the spray tank is made of non-corrosive metal such as copper or else is coated inside with an anti-corrosive paint. Alternatively the bluestone can be

dissolved in a large wooden barrel but not in an iron or galvanised iron tank.

(b) Slake 4 lb. of fresh quick lime with water in a bucket and then dilute with more water to make 5 gallons of lime suspension (one tenth of the total valume). If using fresh hydrated lime dilute in the same manner but increase the amount of lime to 6 lb. (1½ times the quantity of quick lime stated in the formula.)

(c) Set the agitator of the spray tank in motion and pour the lime suspension through a suitable strainer into the bluestone solution. If using a wooden barrel the solution should be stirred with a wooden paddle.

(d) Add appropriate spreader (see later section).

The resulting Bordeaux mixture should be used immediately as it is less effective when kept for use later in the day or until the following day.

All other formulas for Bordeaux mixture are made up in a similar manner, with the required amounts of bluestone, lime and water being substituted for those in the above formula.

For preparation of small quantities the following method should be adopted:—

To make 2½ gallons of Bordeaux mixture at 4 : 4 : 50 strength:—

(a) Dissolve 3¼ oz. of bluestone in 2¼ gallons of water in a copper, wooden, glass or enamel vessel.

(b) Slake 3¼ oz. of fresh quick lime (equals 5 oz. of fresh hydrated lime) in another container in ¼ gallon of water.

(c) Pour the lime suspension through a strainer into the dilute bluestone solution and at the same time stir the mixture with a wooden paddle.

(d) Add appropriate spreader (see later section).

The resulting Bordeaux mixture should be used immediately and not kept for use later in the day or until the following day.

USE OF A SPREADER AND STICKER

To ensure maximum coverage and adhesion of the Bordeaux fungicide on the plant surfaces it is usually necessary to include a spreading and sticking compound in the spray. Calcium caseinate or white oil are commonly used for this purpose and they should always be added last to the mixture in the spray vat or barrel. Calcium caseinate is available under such trade names as "Calspread" and "Nosco spray spreader." Rates of usage of these materials are stated on the containers.

TEST FOR NEUTRALIZATION

If all the bluestone in the mixture is not neutralised by adding sufficient lime the plants may be burnt by the copper sulphate still in solution. The quality of local lime often varies considerably and it may be necessary to add extra lime to the spray to ensure complete neutralisation.

A quick test to check if all the bluestone has been neutralised can be done by dipping a shiny nail into the spray vat for a few minutes. If insufficient lime has been added a coppery deposit will form on the nail and more lime must then be used.

BORDEAUX PASTE

Bordeaux mixture in paste form has proved suitable for covering over fresh cuts and wounds on limbs of fruit and other trees. It protects the exposed wood against attack by wood rotting fungi. The paste is similar in composition to standard Bordeaux mixture but contains much less water.

To make a small quantity of Bordeaux paste dissolve 1 oz. of bluestone in ½ pint of water and slake 1 oz. of quick lime (equals 1½ oz. fresh hydrated lime) in ½ pint of water. The two materials are then combined and produce a mixture of paint-like consistency.

REGISTERED FERTILISERS

1960-61

THE FOLLOWING REGISTERED FERTILISERS AND ANALYSES ARE SUPPLEMENTARY TO THE LIST PUBLISHED IN THE JANUARY 1961 ISSUE OF THE JOURNAL OF AGRICULTURE . . .

Name of Fertiliser	Reg. No.	Registered Brand	By Whom Registered	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Minor Elements								Cash price per ton at Works (W) or on rails at Perth (P)
				Nitrate	Ammonia	Blood and Bone	Urea	Wat'r soluble	Citrate soluble	Acid soluble	Total	Sulphate	Muriate	Cu	Zn	Co	Mn	Mg	Fe	Mo	B	Al	
				%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
A. MINERAL																						
1c. Nitrogen as Urea																						
Kwikleaf 46	304	Hortico	Horticultural Industries Pty. Ltd.	....	.	....	46·0	. .	. .	. .	....	....	....	....	....	....	....	....	....	.	....	....	£106 (P)
Urea	309	ICI Fertiliser Urea	Imperial Chemical Industries of Australia & New Zealand Ltd.	...	...	...	46·0	....	...	....	....	....	....	...	...	...	...	....	....	....	....	..	£62 10s. (P
9. Nitrogen, Phosphoric Anhydride. Potash and Minor Elements																						
No. 1 Complete Plant Food	300	Hortico	Horticultural Industries Pty. Ltd.	....	....	4·0	....	....	7·0	9·0	16·0	4·0	....	Trace	Trace	....	Trace	....	Trace	Trace	Trace	..	Packets
No. 2 Complete Plant Food	301	do.	do. do.	....	<—3·0—>		.	11·0	1·0	3·0	15·0	3·0	....	Trace	Trace	....	Trace	Trace	Trace	Trace	Trace	....	Packets
No. 3 Complete Plant Food	302	do.	do. do.	....	<—7·0—>		....	2·0	3·0	2·0	7·0	14·0	....	Trace	Trace	....	Trace	Trace	Trace	Trace	Trace	..	Packets
No. 4 Soluble Lawn Food	303	do. ..	do. do.	....	16·0	.		1·0	.	.	1·0	....	8·0	Trace	. .	....	Trace	Trace	Trace	....	....	....	£80 15s. (P)
Rhodo-Daphne Tonic	305	do. ..	do. do.	....	<—3·5—>		....	7·0	2·8	3·7	13·5	7·5	....	Trace	Trace	....	Trace	Trace	Trace	Trace	....	..	£68 (P)
11. Trace Elements																						
Zinc Sulphate	308	Lanes	Lanes (W.A.) Pty. Ltd.	....	....	....	....	....	....	....	....	....	....	....	22·0	....	....	....	....	....	....	....	£74 (P)
12. Liquid Fertilisers																						
Liquid Fertiliser	307	Aquasol .	Horticultural Industries Pty. Ltd.	....	....	....	18·0	12·0	....	....	12·0	18·0	....	Trace	Trace	....	Trace	Trace	Trace	Trace	Trace	....	£180 11s. 8d (P)
B. ORGANIC																						
1. Blood and Bone																						
Blood and Bone	306	Hortico	Horticultural Industries Pty. Ltd.	....	....	5·0	....	....	6·0	11·0	17·0	....	....	....	....	....	....	....	....	....	....	....	£63 5s.

Honey Flora Calendar for April

COMPILED BY R. S. COLEMAN, APICULTURAL SECTION, WITH ASSISTANCE FROM THE BOTANICAL BRANCH

Common Name	Botanical Name	Where Found	Honey		Quality of Pollen	Remarks
			Quality	Quantity		
Lustre-leaved Mallee	*Eucalyptus foecunda* Schau.	Widely distributed in the agricultural and pastoral areas	Unknown	Good (one report only)	Unknown	This could be a good future honey plant.
Swamp Yate or Flat-topped Yate	*E. occidentalis* Endl.	Throughout Great Southern and along south coast	Choice	Poor to good	Unknown	Uncertain yielder, as liable to be attacked by parasites and flow is often interrupted by rain. Usually flowers every year.
Salmon Gum	*E. salmonophloia* F. Muell.	Principally in the wheat belt	Good	Poor	Poor	Uncertain flow. Quite a number of trees budding in outer wheat belt at present.
Mirret	*E. celastroides* Turcz.	Goldfields and southern Mallee areas	Unknown	Unknown	Unknown	The activity of insects on these trees when flowering indicates that they could be good honey producers.
Blackbutt	*E. patens* Benth.	South-West. Mainly in depressions or along streams. Manjimup-Bindoon	Good	Good	Good	Buds and flowers similar to Marri as far as time and sensitivity to climate. Not enough stands known. Collie-Balingup best stands.
Powderbark Wandoo	*E. accedens* W. V. Fitzg.	Occurs on the ironstone ridges of the northern parts of the Jarrah forest	Good	Heavy to medium	Excellent	Powderbark can be differentiated from Wandoo by the powdery bark and from the fact that in early winter the bark has a salmon colour. Starts to flower at the end of January and invariably sheds some mature buds just before flowering. This seems to lessen the crop of honey. Buds are held for three years, much the same as Wandoo.
Morrel	*E. oleosa* F. Muell. var. *longicornis* F. Muell.	Wheat belt area	Good	Unknown, but a few reports indicate good yields	Good	A tall tree on good soil, widely scattered and difficult to find enough trees to work as a flow. Could be tried when nothing else available. No information on buds.
White Gum or Wandoo	*E. redunca* Schau. var. *elata* Benth.	Winter flowering Wandoo found from Chittering north-west to Moora	Excellent	Excellent	Excellent	Tends to flower in the valleys. Major honey plant. Very little budded to flower this year.

Marri	*E. calophylla* R. Br.	Enneabba to the south coast	Excellent ...	Excellent	Excellent	Major honey plant, very sensitive to climate
Red Tingle	*E. Jacksonii* Maiden	Southern Karri forest, Denmark	Excellent	Excellent	Excellent	Not big enough stands.
Sugar Gum	*E. cladocalyx* F. Muell.	Not a native of W.A. but used as a street tree	Good	Heavy	Good	Since this tree is planted extensively in some towns the local beekeepers get a good crop. Buds believed to be one year old at flowering
Hooked Mallee	*E. uncinata* Turcz.	Mallee areas. Esperance to Geraldton	Very little known in Western Australia. In Victoria and South Australia regarded as excellent	Good in South Australia and Victoria	Good in South Australia and Victoria	Not worked enough in Western Australia.
Tuart	*E. gomphocephala* D.C.	Moore River-Busselton	Very good	Good	Poor (?)	Buds usually dropped by borers. Could be a flow in Mandurah and Busselton areas.
Menzies Banksia	*Banksia Menziesii* R. Br.	Coastal sand plain	Good	Poor to good	Unknown	Grows in association with other honey-producing plants. Keeps "brood raising" going.
Rottnest Tea Tree	*Melaleuca pubescens* Schau.	Rottnest, Cape Naturaliste, Dongara only	Poor	Good	Good	Only three stands known.
Holly-leaved Banksia	*Banksia ilicifolia* R. Br.	Sandy soils of the coastal plain	Unknown	Uncertain	Good	Long-flowering. No large areas.
Acorn, Silver, or Orange Banksia	*B. prionotes* Lindl.	Coastal and sandplain areas	Poor	Poor to good	Good	Differing views held on this Banksia. Probably good producer in some areas. Main fault is that the tight cones trap bees.
White Heath	*Leucopogon propinquus* R. Br.	Poor sands throughout wetter portion of State, inland as far as Narrogin	Good	Good	Good	Importance of this plant is its time of flowering, producing when there is little else. Rain does not penetrate the flower and the nectar is not diluted.

It will be seen from this list that information concerning many nectar-bearing plants is far from adequate. We would appreciate further information from beekeepers.

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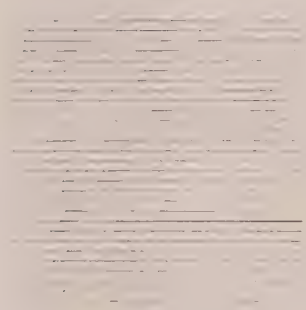

By D. C. MICKLE, Dairy Produce Inspector

THERE can be no doubt in anyone's mind that the need for a clean, safe and adequate water supply is essential for the production of high quality milk and cream. It naturally follows, that, even though every possible care has been taken in an endeavour to produce clean, germ-free milk and cream, contamination by bad water can render these efforts void.

A contaminated water supply has quite often arisen from carelessness or lack of appreciation of just how easy it is for the water supply to become unsafe. Polluted water enters streams, wells and springs and open types of reservoirs through surface run-off and openings from underground channels. Drainage underground from septic tanks, open cess pools, cow yards and abandoned wells or soaks can ruin the purity of your water supply very quickly.

On the dairy farm, nearly all surface water is contaminated, particularly that in close proximity to the dairy buildings and yards. Any underground water within 10 feet of the surface of farm yards can be impure. Especially is this so with wells and springs in limestone country for such type of country commonly has large cracks and fissures through which water can pass rapidly for great distances with very little, if any, filtering action. It is important, therefore, that no cess pools or holes containing farm wastes, including dead animals, be permitted on limestone country. In sandy and loamy soils, water moves more slowly and many impurities are removed. However, even under the best of soil filtration conditions, wells should be situated not less than 100 feet from dairy buildings, yards and septic systems. This is of greater importance if the water is drawn from a shallow well.

In selecting the site for a new well, it is important to remember that it is best it be located up the slope above any possible source of contamination. Dig a good ditch around the well or construct a solid gutter above the well to direct the surface water to at least about 25 feet away from the well opening. Many dairy farmers make use of springs for water supply. Some springs dry up during summer, indicating that their flow is close to the surface, and, hence, open to surface contamination by coliform bacteria. It is essential that the area about the spring be fenced off and then protected from impure surface water drainage and any foreign matter. This can be done by enclosing the spring-head with a strongly built concrete box, with a removable lid for inspection and provided with a pipe outlet for draining off water rather than bucketing it from the supply.

Dams are in common use as a means of water supply on farms and have the advantage over a stream or creek in that drainage into them is more easily controlled, but here again, the first consideration as to site is the protection from drainage from farm yards, dairy buildings and

sewage disposal areas. Such dams as provide water for farm domestic use as well as dairy premises, must be securely fenced against encroachment by farm animals.

The fact that water tastes and looks good, is not proof that it is pure. The only way to be sure in case of doubt is to have a series of samples taken for bacteriological testing in a laboratory. If it is desired to secure such samples, an application to a laboratory should be made for assistance and instruction of how to secure samples of water in the proper manner.

Finally, remember the important points are:—

(1) Locate your supply properly.
(2) Protect it from surface contamination.
(3) Test the water periodically for purity.

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BOOKS... *for FARMERS*

THE following books on agriculture, recently published and obtainable to order from most booksellers, have been added to the stock of the Library Board of W.A., and may be borrowed freely from any public library associated with the Board, or consulted at the State Library of Western Australia.

GENERAL

A BIBLIOGRAPHY OF FARM BUILDINGS RESEARCH, 1945-1958; issued by the Agricultural Research Council of Great Britain. Lond., 1959.

FIRST REPORT, 1959, of the Tropical Products Institute, Great Britain. Lond., 1960.

[PROCEEDINGS] OF THE VEGETABLE RESEARCH CONFERENCE, held at Warburton (Vic.), 1959, by the C.S.I.R.O. Melb., 1959-1960.

FARM MANAGEMENT

THE CRISIS IN FARM COSTS AND INCOMES: A study of factors affecting primary producers and export industries. Issued by the Australian Country Party. (Syd.).

PROCEEDINGS OF THE RESIDENTIAL SCHOOL IN AGRICULTURAL ECONOMICS AND FARM MANAGEMENT, Armidale, 1959. [Armidale (N.S.W.), 1959.]

CROP MANAGEMENT

[PROCEEDINGS] OF THE CONFERENCE OF SEED TESTING OFFICERS, Sydney, 1959, held by the C.S.I.R.O. Melb., 1960.

SOILS AND FERTILISERS

ABSTRACTS: Potash; issued by Division of Agricultural Production of the Commonwealth Department of Primary Industry. Canb., [1959?].

FERTILISERS AND PROFITABLE FARMING; by G. W. Cooke. Lond., 1960.

RECONSTRUCTION BY WAY OF THE SOIL; by G. T. Wrench. Lond., 1946.

IRRIGATION

SPRINKLER IRRIGATION. 2nd ed. compiled and edited by Guy O. Woodward, for the Sprinkler Irrigation Association. Washington (D.C.), 1959.

DISEASES AND PESTS

[PAPERS] OF THE SECOND AUSTRALIAN WEEDS CONFERENCE. Melb., 1960.

[PROCEEDINGS] OF THE CONFERENCE ON ROOT ROTS OF WHEAT, held at Wagga Wagga (N.S.W.), 1960, by the C.S.I.R.O. Melb., 1960

REPORT OF THE THIRD AGRICULTURAL AVIATION RESEARCH CONFERENCE, 1958. Washington (D.C.), 1959.

FIELD CROPS

HISTORICAL STATISTICS OF THE AUSTRALIAN WHEATGROWING INDUSTRY: acreage and average yield in counties and divisions, New South Wales; Victoria; South Australia [and] Western Australia. 1792-1950. Compiled by E. Dunsdorfs and L. Dunsdorfs Melb.; 1956.

FRUIT GROWING

APPLE PACKING; by K. O. Cantrill. Issued by the Division of Horticulture, New South Wales Department of Agriculture. [Syd.], [1956].

THE ECONOMICS OF DRIED VINE FRUIT PRODUCTION IN THE SUNRAYSIA DISTRICT: 1st Annual Report, 1958-1959, issued by the Bureau of Agricultural Economics. Canberra, 1960.

THE FIG; by I. J. CONDIT. Waltham (Mass.), 1947.

FRUIT TREES AND THE SOIL; by D. E. M. Wright. Lond., 1960.

FORESTRY

PROBLEMS IN TREE NUTRITION: An account of researches concerned primarily with the mycorrhizal habit in relation to forestry and with some biological aspects of soil fertility; by M. C. Rayner, and W. Neilson-Jones. Lond., 1944.

TIMBER RESOURCE REVIEW. Preliminary review draft subject to revision, issued by the United States Forest Service. Washington (D.C.), 1955.

TREE MAINTENANCE; by P. P. Pirone. N.Y., 1959.

LIVESTOCK

THE A TO Z OF HORSES: All you need to know about buying, conformation, diseases, feeding, foaling, gaits, jumping, training, etc.; by C. E. G. Hope. Lond., 1960.

THE AUSTRALIAN GRAZING INDUSTRY: A review of factors influencing production in the sheep and wool industry; by G. D. Chislett. Syd., 1960.

BEEF CATTLE; by R. R. Snapp and A. L. Neumann. 5th ed. N.Y., 1960.

CATTLE COUNTRY: An illustrated survey of the Australian beef cattle industry [and] a complete directory of the studs; by F. O'Loghlen and F. H. Johnston, eds. Syd., 1960.

OF SHEEP AND MEN; by R. B. Robertson. Lond., 1960. The course of life in a border glen of Scotland where everyone talked of little else but sheep.

PROFITABLE PIG FARMING; by G. Johnson. Ipswich (Suff.), 1959.

POULTRY

BROILERS: Production and management; by E. F. Golden. 2nd ed. Lond., 1960.

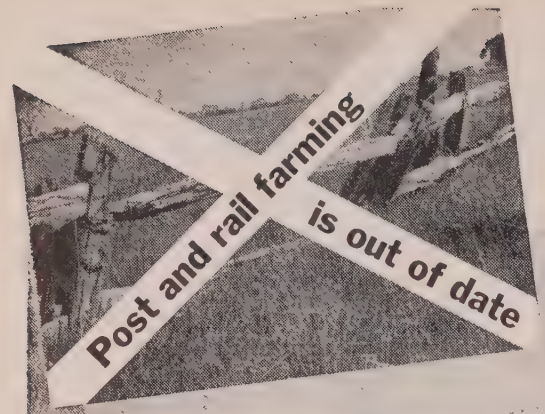
DAIRYING

COST AND EFFICIENCY IN MILK PRODUCTION: A report of the National Investigation into the Economics of Milk Production, 1955-1957, issued by the Provincial Agricultural Economics Service. Lond., 1960.

IN-PLACE CLEANING OF DAIRY EQUIPMENT; issued by the Society of Dairy Technology, London. Lond., 1959.

BEE-KEEPING

BEES AND HONEY [by W. A. Goodacre]. 4th ed., [rev. by officers of the Apicultural Section] of the New South Wales Department of Agriculture. Syd., [1960].



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MULESING PAYS

by
W. L. McGARRY,
Officer in Charge, Sheep and Wool Section

THERE is little doubt that the combined mules and tail strip treatment is still far ahead of all other blowfly control measures. This treatment can and should be carried out as farm or station routine practice in the same way as are other accepted management practices, such as lambmarking, drenching, etc.

Experience in W.A., among many flocks, both large and small, has clearly shown that flock owners have nothing to lose and a lot to gain at negligible cost, by treating their ewes as part of yearly routine practice. All young ewes should be treated, either as weaners at their first crutching in the autumn, or as lambs at marking.

No special skill is required to mules and tail strip sheep and with practice the treatment can be done efficiently by any station or farm hand.

Officers of the Sheep and Wool Section are demonstrating the treatment in the agricultural areas during March and April this year on freshly crutched flocks.

Farmers will be shown the technique on 200-300 of their own sheep and thus will be given a good start off with their mulesing operations.

Farmers desiring to participate and who can make flocks available should apply now to the Sheep and Wool Section, Department of Agriculture, South Perth or contact their nearest District Agricultural Adviser.

Officers of the Sheep and Wool Section demonstrating the mules and tail-strip treatments. At right, are shown the two ewe weaners which have just been treated

BROWN BETTY

- ¼ lb. Butter or Margarine.
- 6 oz. Brown Sugar.
- 1 Egg.
- 1½ cups of S.R. Flour.
- ½ teaspoonful Salt.
- ½ cup of Coconut.
- 1 cup of Cornflakes.
- 1 cup of Sultanas.

Method.

Melt butter or margarine, add well beaten egg and sugar, beat till creamy, then add dry ingredients, beat all well. Pat into shallow well greased biscuit tray. Bake in a moderate oven 20 to 30 minutes. Cut into squares when cool.

Australian

TRACTOR TESTS

FORDSON FARM MAJOR

REPORT ON TEST No. 33 (FARMERS' EDITION)

TESTED FOR FORD MOTOR CO. OF AUSTRALIA PTY. LTD., GEELONG, VICTORIA

THIS Report is taken from the full Technical Report No. 33 of this test; test results are shown here in briefer form: fuller explanations are added. Values quoted may be rounded out to two instead of three significant figures; to this extent the values may differ slightly but not significantly from those shown in the Technical Report. Graphs of belt test performance, shown in the Technical Report, are not shown here. The Technical Report is not available in large numbers, but it may be seen at, and copies of this farmers' report may be had from, the offices of the State Departments of Agriculture, the Bureau of Sugar Experiment Stations (Queensland), and the Commonwealth Department of Primary Industry.

1. THE TESTS

(1) After twelve hours of running-in, two types of test were carried out, in order to measure *the performance of the engine*, as measured by the power in the belt driven by the belt pulley, and *the performance of the tractor as a whole*, as measured by drawbar pull, tractor speed, wheel slip, and drawbar horse-power (d.b.h.p.), with the tractor running on a bitumen test track.

The main results of these tests are given in Sections 2, 3, and 4. Other measurements and observations were made of various features of the tractor; these are given in Section 5.

Note.—As from Test No. 32 tests have also been run on the engine removed from the tractor. All normal auxiliaries remain fitted and functioning; power output (shaft horse-power, s.h.p.) is measured at the crankshaft. See Section 2.

(2) *Fuel Settings.*—The engine of this tractor has only one fuel setting, at which all the tests were carried out.

(3) *Governor Control.*—The engine was under the control of the governor set to give full fuel delivery, and so full power rated engine speed. (See note 2, paragraph 5, Other Observations, below.)

(4) *Fuel.*—Distillate, Diesel Index 54, Specific Gravity 0.84; weight per Imperial gallon 8.41 lb.

(5) *Specification.*—Engine No. 1506121. For a brief specification of this tractor see Section 6 at the end of this report.

The Australian Tractor Testing Committee is a joint body established by agreement between the Commonwealth, the States, and the University of Melbourne; under this agreement, the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: c/o Department of Primary Industry, 301 Flinders Lane, Melbourne.

2. SUMMARY OF POWER OUTPUT

Table A

	At the Belt	At the Drawbar
Rated engine speed, r.p.m.	1,600	1,600
Maximum power (*a*)	39·8	34·3
Rated power (*b*)	34 (*b*1)	26 (*b*2)

Maximum shaft horse-power at 1,600 r.p.m. : 43.4.

Note.—Letters in brackets refer to explanatory footnotes.

(*a*) No atmospheric corrections are applied to diesel engines because there is no suitable formula; the values shown above are, therefore, the observed maximum powers.

(*b*) Engines are not expected to run indefinitely at full or maximum power output. But they can be expected to run continuously for some hours at *rated* output, which is less than maximum, defined as follows:—

(*b*1) Rated b.h.p. is defined as 85 per cent. of corrected maximum b.h.p.;

(*b*2) Rated d.b.h.p. is defined as 75 per cent. of corrected maximum d.b.h.p.

3. BELT TESTS

The belt tests show the power (belt horse-power, b.h.p.) that the tractor may be expected to deliver when driving a machine by the belt.

Table B.—Belt Test Results

	B.H.P.	Engine Speed	Fuel: Gall./hr. (*c*)	Fuel: lb./b.h.p. hr. (*d*)
1. Rated engine speed, 1,600 r.p.m.				
2. Fast idling speed, 1,790 r.p.m.*				
3. Observed maximum b.h.p. at rated speed	39·8	1,600	2·1	0·44
4. Corrected maximum b.h.p. rated speed (*a*)	39·8	No correction made for diesel engines		
5. Calculated rated load (*b*1)	34			
6. Test at approximately rated load	34·1	1,680	1·8	0·44
7. Average loading under governor (*e*)	22·3	1,712	1·4	0·53
8. Measured engine torque at full fuel delivery	142 ft. lb. at maximum power and rated speed 148 ft. lb. (maximum) at 1,200 r.p.m.			
9. Repeat of (3) above after 57 hours	No change			

* See note 2, paragraph 5, Other Observations.

(*c*) Fuel consumption in gallons/hour may be a simple unit, but it has no meaning unless we also quote the corresponding h.p. output.

(*d*) This is the "specific fuel consumption," the weight of fuel consumed per unit of energy developed by the engine; (the unit of energy here is the h.p. hour, similar to the electrical "unit," the kilowatt-hour). When this figure is least the engine is giving its best economy or efficiency. It is easy to change from column (*c*) to column (*d*) in Table B, e.g., as follows:—

2.1 galls./hr. while developing 39.8 h.p. means 2.1 ÷ 39.8 galls./b.h.p./hr. = 0.053 gall./b.h.p./hr.

0.053 gall./b.h.p./hr x 8.41 lb./gallon for this fuel = 0.44 lb./b.h.p./hr., as shown in column (*d*).

(*e*) Line 7, Table B., represents the average performance one might expect from the engine while driving a variety of belt loads, from light to heavy. In terms of average fuel consumption, it means about 1½ gallons an hour.

4. DRAWBAR TESTS

(1) the following Tables C, D, and E, show the drawbar performance of the tractor, on the bitumen test track, wearing rear typres 12 x 28, carrying maximum weight (1,930 lb. front, 4,980 lb. rear; total 6,910 lb.), working in the gears named in the tables. Height of drawbar 15 inches.

Drawbar tests, using standard weight of tractor (5,400 lb.), were carried out, but are not reported here.

Table C.—Maximum Power, Rated (3rd) Gear

	DBHP (*f*)	Pull lb.	Speed m.p.h.	Wheel Slip % (*g*)
1. Rated engine speed, 1,600 r.p.m.				
2. Observed maximum d.b.h.p. at rated engine speed	34·3	4,350	2·95	11
3. Corrected maximum d.b.h.p. at rated engine speed (*a*)	34·3	No correction made for diesel engines		
4. Calculated rated load (*b*2)	26			

Table D.—Pull at Maximum d.b.h.p.

All gears, rated engine speed. See note (*h*).

Gear	D.B.H.P.	Pull lb.	Speed m.p.h.	Wheel Slip %
1	22 (*i*)	4,800	1·7	16
2	33 (*i*)	4,800	2·6	16
3	34	4,350	3·0	11
4	36	3,100	4·3	7
5	37	2,250	6·2	5
6	Road gear not tested			

(*f*) D.B.H.P. is the product of pull (lb.) and speed (m.p.h.) divided by 375.

(*g*) Wheel slip can be measured by noting that, in travelling a given distance, the back wheels make more turns when working under load than when running with no load on the drawbar. The difference in these revolution counts divided by the former count gives the slip as a ratio, which can be written as a percentage (quoted in these tables to the nearest whole number.)

(*h*) These are not the maximum pulls available in the gears (i.e., not the maximum sustained pulls), but the pulls at maximum d.b. power, i.e., at full-throttle at rated engine speed.

(*i*) Part throttle, maximum d.b.h.p. in first and second gears limited by wheel slip.

Table E. — Fuel Consumption, Various Loads, Rated (3rd) Gear

Pull lb.	Speed m.p.h.	DBHP	Percentage of Maximum d.b.h.p.	Slip %	Fuel: Gall./hr.	Fuel: lb./d.b.h.p. hr.
1,700	3·54	16	47	3	1·2	0·60
2,300	3·45	21	62	5	1·4	0·56
3,000	3·35	27†	78†	6	1·6	0·50
3,650	3·26	32	92	8	1·8	0·47

† Approximately rated drawbar load.

(2) *Interpretation of Drawbar Tests—*

(i) Drawbar tests are carried out on a hard, prepared surface. Most field conditions present higher resistance to the tractor's motion, so that, in the field, the maximum drawbar pulls available in any gear will usually be less than those shown in the tables.

(ii) Wheel slip may also be greater in the field; to that extent tractor speeds in miles per hour in the field will be less than those shown in the tables.

(iii) Because of (i) and (ii) above, the drawbar horse-powers available in any gear in the field will usually be less than those shown in the tables.

5. OTHER OBSERVATIONS

(i) *Duration of Test.*—57 hours, including running-in.

(2) *Repairs and Adjustments.*—High idle speed was reduced from recommended 1,900 r.p.m. to 1,790 r.p.m. to give maximum power at rated speed.

(3) Engine—

Fuel Settings—one, fuel pump calibration checked in accordance with specification.

Heat controls—radiator and 4-blade fan, thermostat.

Radiator water used—none.

Lubricating oil—S.A.E. 20.

Weight to engine, 16.8 lb.;

Weight from engine after tests, 14.0 lb.

(4) *Tractor Weights (lb.).*

Weight Condition	Front	Rear	Total
*Standard, unballasted	1,930	3,470	5,400
†Maximum weight, heaviest recommended	1,930	4,980	6,910
Includes—			
Water ballast (lb./wheel)	....	325	325
Solid ballast (lb./wheel)	....	430	430

* This weight, including driver and fuel, was used in finding centre of gravity.

† Weight of tractor in drawbar tests quoted in this report.

(5) *Wheels and Tyres—*

Tyres	Front	Rear
Type	Rib	Open centre bar tread
Size	6·00 x 16, 6-ply	12 x 28, 6-ply
Pressure	28 psi.	12 psi.

(6) *Steering.*—With track widths, front 54½", rear 58", wheel base 80":—

Turning circles: Without brakes, 29′ 0" L.H,. 28′ 6" R.H.; with brakes, 23′ 8" L.H., 22′ 8" R.H.

Comment: Easy to steer under load, sensitive to steering wheel; no power assistance.

(7) *Centre of Gravity,* with tractor in standard weight—3" below, 28½" forward of rear axle.

(8) *Driver's Accommodation.—Access to seat,* from either side forward of rear wheels. *Foot-room and support* flat foot plates, adequate. *Comfort,* deep plough-type seat with rubber cushion and backrest. Seat folds up for weather protection, and has quick release adjustment for pushing back to facilitate stand-up working. *Accessibility to controls,* satisfactory.

Noise, sound pressure level measured 3 feet above loaded seat in open field—

at full power rated speed—102 units.

at fast idling speed—93 units.

The special unit is the decibel (db) of pressure compared with a base level of virtual silence. The levels quoted above are typical of tractors, which generally are noisy by accepted industrial standards.

(9) *Instruments.*—All clearly visible, markings adequate. Indications were consistent throughout tests.

Engine tachometer is marked for Standard p.t.o. and belt speeds; road speed markings do not apply to the recommended wheel equipment.

(10) *Inspection of Engine and Transmission after Test.*—After testing, the tractor was partly dismantled and inspected and found to be in a satisfactory condition.

(11) *Instruction Books.*—Instructions for starting, running, and maintenance were satisfactory, and well illustrated.

6. BRIEF SPECIFICATIONS

Fordson Farm Major. (Based on Information Supplied by Manufacturers)

(1) *Engine*—No 1506121.

4-stroke; 4 cylinders, vertical; crankshaft along tractor; direct injection diesel.

Bore, 3.937"; stroke, 4.524"; compression ratio, 16 : 1.

Rated speeds: Belt and drawbar work, 1,600 r.p.m.

Fuel type: Distillate.

Fuel system: Simms 4-cyl. in-line pump, 4-hole spray type injectors. Two replaceable-element filters in series. Tank capacity, 15 gallons.

Air Cleaner: Oil bath, perforated metal and fibre pre-cleaner.
Governor: Pneumatic, incorporated in fuel pump.
Electrical system: 12-volt battery and generator.
Starting: Electric, cold starting.

A Fordson Farm Major under test.
(Manufacturer's Photo.)

Cooling: Water (pressure system) fan, pump, and thermostat.
Exhaust: Vertical ahead of operator. Standard Fordson Major Spark arrester.
Lubrication: Replaceable element filter.

(2) *Chassis*—
4-wheel; pneumatic tyres.
Wheel base 80″.
Track widths: Front 50½″ x 4″ steps to 74½″; rear 58″ x 4″ steps to 72″.
Tyre sizes: Front 6.00 x 16; rear 12 x 28.
Steering: Recirculatory ball drive.
Weight: Maximum, 6,910 lb.

(3) *Belt Pulley*—
R.H. side, forward working, clockwise rotation. Diameter 8½″; face width 6¼″. 2 speeds (at rated engine speed), high, 1,600 r.p.m.; low, 890 r.p.m.
Belt speed (at rated engine speed), high 3,560 ft./min., not in accordance with overseas standards (namely, 3,100 ± 100 f.p.m.). At 1,400 r.p.m. engine speed, belt speed would be 3,115 ft./min.

(4) *Power Take-off*—
Centre rear; clockwise; guarded.
Speed (at rated engine speed) 540 r.p.m.; in accordance with overseas standards (namely, 536 ± 10 r.p.m.).
Dimensions: 6 spline, 1⅜″ diameter.

(5) *Drawbar*—Swinging—9 positions across.
Height, adjustable, 13″, 11″, 9″.
Linkage mounted drawbar also available.

(6) *Transmission*—Conventional gears.
Clutch: Single dry plate; 11″ diameter.
Gear ratios and road speeds (assuming no wheel slip) on 12 x 28 tyres, at rated engine speed, as advertised.

—	Forward						Reverse	
Gear	1	2	3	4	5	6	L	H
Ratio	123·0	87·3	68·4	48·6	34·8	19·3	91·1	50·7
Speed m.p.h.	1·8	2·6	3·3	4·6	6·5	11·6	2·5	4·4

(7) *Hydraulics*—Built-in, gear pump in rear axle.

(8) *Three-point Linkage*—Generally conforms to BS1841-1951, Category 2.

G. H. VASEY, Officer in Charge Tractor Testing.
W. F. BAILLIE, Tractor Testing Officer.
September, 1959. University of Melbourne.

CARTON PACKS For GRANNY SMITHS

By J. S. BLOOMFIELD, Packing Instructor

CONSIDERABLE quantities of Granny Smiths will be exported in carton containers in the 1961 season. Last season an inaugural trial of tray pack cartons was shipped to the United Kingdom but this year will see the first use of cell pack cartons.

Limited packing trials have been conducted recently to determine correct sizing and packing for cell packs and the results of these tests are discussed in this article. A detailed comparison is also made with the tray carton and the Australian Apple Box.

These trials have demonstrated that Granny Smiths can be satisfactorily packed in cells. However, this is the first use of this type of packaging in this State and commercial experience in the coming season will indicate the practical problems involved.

A straight pack for the 2¾ Granny Smith apple—a 128 count.

A crosswise pack for the 2⅞ Granny Smith apple—a 112 count.

A straight pack for the 2½ Granny Smith apple—a 160 count.

A crosswise pack for the 2⅝ Granny Smith apple—a 140 count.

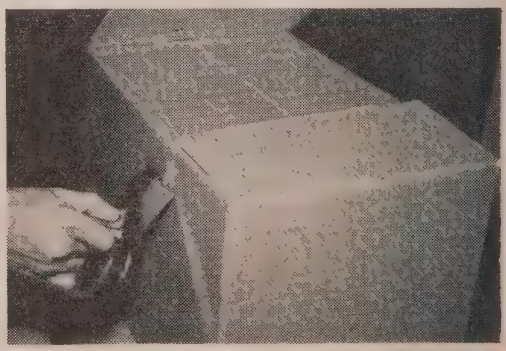
The procedure adopted was to obtain a number of dump boxes of Granny Smiths with a range of sizes, resize the fruit by hand and determine the size range required to give satisfactory packs in cartons and also the net weight obtained in each instance.

CELL PACK CARTONS

The following chart sets out fruit size and count carton size cell arrangement and method of placement of fruit for carton.

Size	Count	Carton Dimensions	Cell Arrangement
2⅜	180	20⅝ x 12 1/16 x 10 11/16	9 x 5 x 4 straight
2½	160	18 11/16 x 12⅝ x 10 1/16	8 x 5 x 4 „
2⅝	140	18⅝ x 12⅝ x 10 11/16	7 x 5 x 4 crosswise
2¾	128	20 11/16 x 11 1/16 x 11 1/16	8 x 4 x 4 straight
2⅞	112	20⅝ x 11 1/16 x 11 1/16	7 x 4 x 4 crosswise
3	96	18 1/16 x 11 1/16 x 12 1/16	6 x 4 x 4 „

It will be noted that cell packs can be packed in ⅛ inch sizes and thus less packs are involved than either the tray pack carton (identical counts to standard apple box) or the Australian Apple Box. The carton for each count is of a different size and cells are not interchangeable.

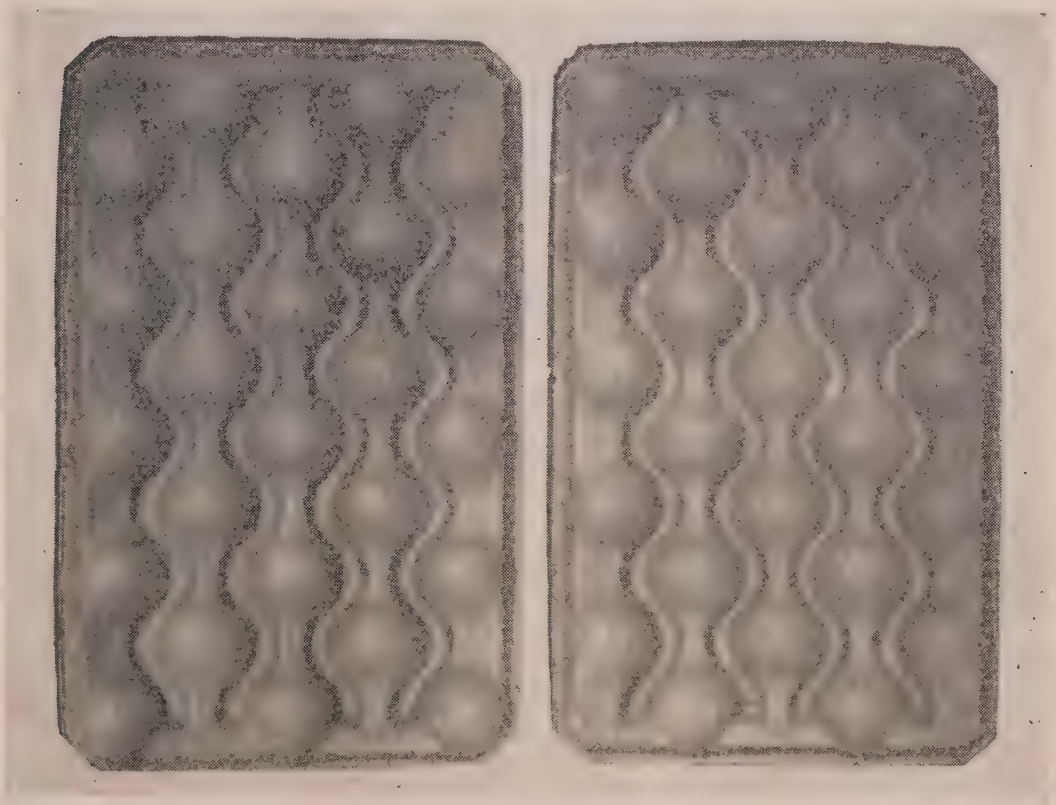


Sealing a cell pack carton with special rayon tape. The dispenser enables equal lengths of tape to be neatly applied.

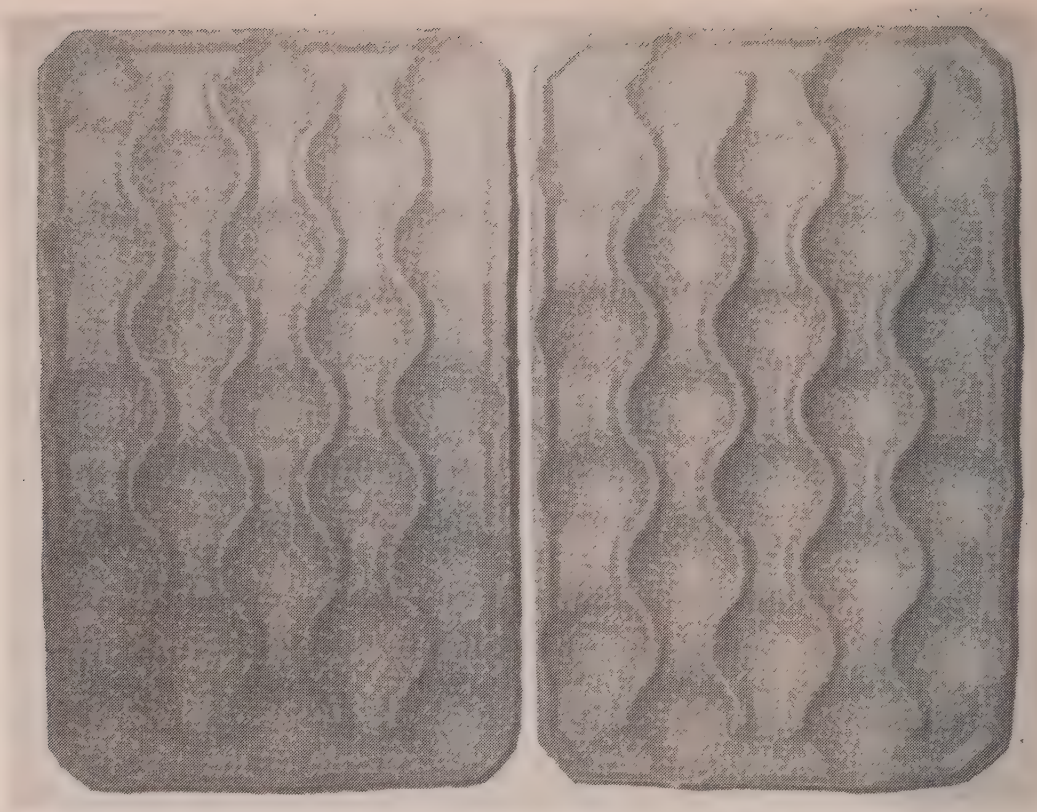
With a suitable stapling machine two staples are positioned in each flap in line with the dividing cell partitions thus obviating damage to the apples

There appears to be little difficulty in placing all normal shaped Granny Smiths in the cells and should a long type be a little tight it can be evened up by placing a flatter apple in the next cell. There is sufficient flexibility in the cell walls to enable all fruit in the one size range to be packed satisfactorily. Oversized apples will not fit in the cells and must be transferred to the next bin. If they are forced in they will cause the carton to spread and subsequently damage the outside fruits. In a correctly packed cell pack carton the apples should fit firmly enough that a layer may be removed without the centre apples falling out. The nett weight approximated 40 lb.

The experiment proved that the 160 count, a $2\frac{1}{2}$ apple, could be packed from the same bin as the 175 tray pack and the 175 count in the dump box. There are no other similarities with tray pack or dump box.



Reversible trays for the 3-2, 5 x 5—125 count. Counts 100, 125, 150 and 175 use reversible trays.



Non Reversible trays for 3-2, 5 x 4—113 count. A tray left begins and ends with three pockets. B tray right begins and ends with two pockets. Counts 113, 138 and 163 use non reversible trays.

Some method of assembling the cells and supplying the cartons to the packers will have to be worked out in handling a commercial consignment. It would appear that cells should be assembled before delivery to the packer. As an illustration the 160 count has 44 pieces of cardboard for constructing the cells namely 16 long, 28 short plus three dividing pads. The different dimensions of cartons for each count emphasises the need for effective organisation of the assembly and delivery of packing materials to the packers and stacking of the final product.

Apples in cell packs are placed on their cheeks either as in the straight pattern pack with stalks towards the packer or crosswise across the carton depending on the count. Quality grading needs careful attention as once an apple is placed in a cell it is very difficult to remove.

Cell packs can be fastened either by stapling or taping. Both methods as illustrated appear satisfactory and would enable the carton to be opened for inspection and refastened.

With care two staples can be positioned in each flap along the dividing cell partitions leaving no possibility of damage to the apples. Arrows could be printed on the cartons to indicate the position for the staples. This would prevent the anvils that pierce the carton before the staple is fixed in position from doing any damage to the apples. A special rayon tape and applicator are required for taping which is easily and quickly applied as an alternative to stapling. To produce a neat seal the tapes must be of even length and carefully applied.

TRAY PACK CARTONS

During the 1960 season almost 6,000 tray pack cartons of Granny Smiths were shipped to the United Kingdom. This provided an excellent opportunity of

studying the packing and handling of the tray pack carton as an export container.

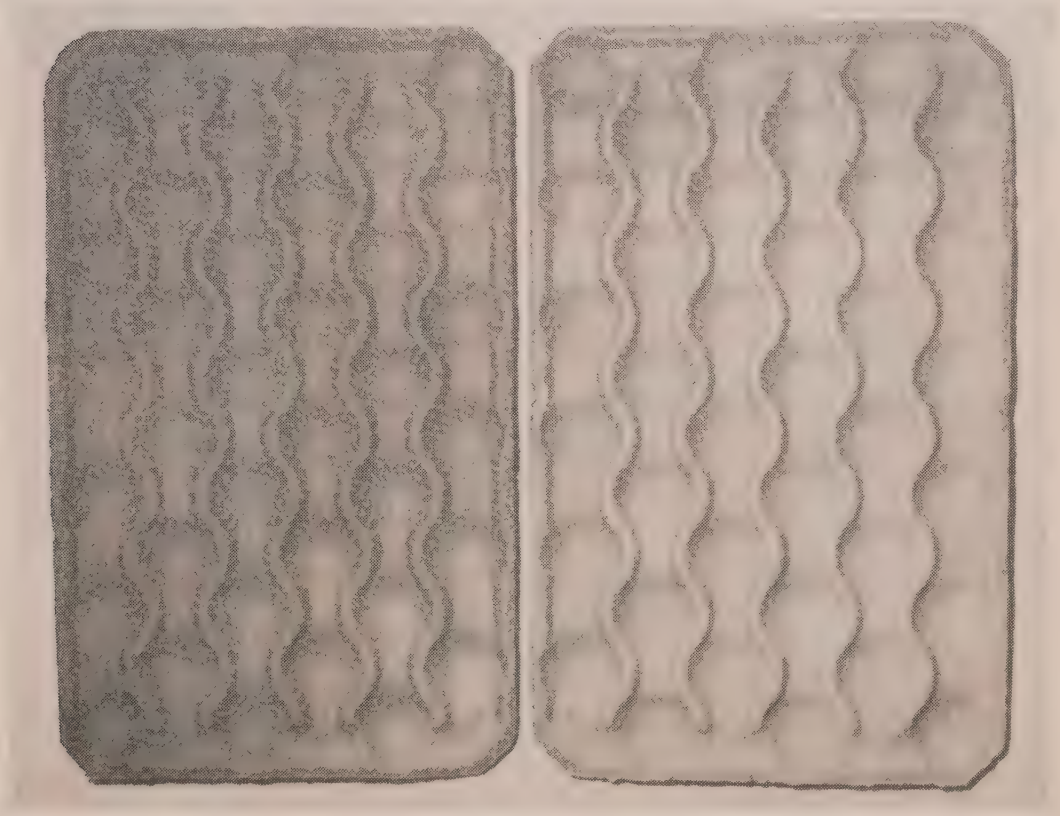
The counts from tray pack cartons to be used for this season will range from 175 to 100. Of these counts the 175, 150, 125 and 100 have reversible trays. It is preferable to commence packing with the 2 pockets towards the packer thus enabling the carton to finish with 3 apples away from the packer. This gives a better presentation when opened and displayed for sale. With the other packs 163, 138 and 113, A and B trays are required. For the correct count it is essential to commence with the A tray which has 3 pockets at either end. The B tray commences with two apples and finishes with two.

The height of a tray packed carton is determined by the size of the apples in the trays and it is necessary to pack apples of an even size in each tray otherwise damage to the larger fruits may occur. Most of the complaints regarding bruising relate to the larger size Granny Smith apples. Unless the fruit is properly sized for tray pack cartons the effect on bruising may be little better than in orthodox packs. Oversize apples will take the pressure in stacking while undersized fruits will move about in the pockets.

As a result of last seasons experience capper trays will be used this year to prevent movement in the top layer and lids will also be fastened to prevent them riding up. The rayon tape mentioned earlier for cell pack could be useful for this purpose.

Trials with flat apples in tray pack have not been very successful as the apples move in the pockets and it has not been possible to reach the required net weights.

Careful stacking of cartons for transit is essential to prevent surface damage to the containers as occurred in some instances last season.

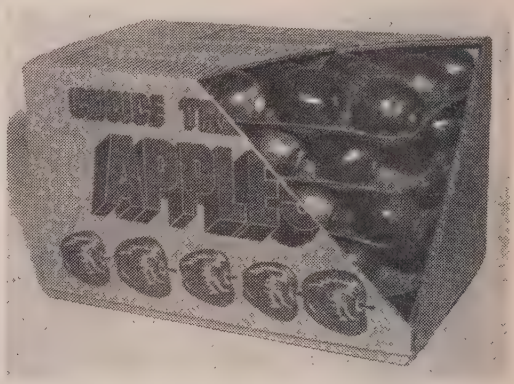


Non Reversible trays for 3-3, 6 x 6—216 count. (Note for the 198 count (3-3, 6 x 5) reversible trays are used.

Tray pack cartons on pallets in a cool store last season prior to shipment

COMPARISON WITH TRAY PACKED CARTONS

The size relationship of the various counts in tray pack and cell pack cartons indicates that the sizing machine settings are only similar for the $2\frac{1}{2}$ size, that is the 175 count in the tray pack and the 160 count in the cell pack. The $2\frac{5}{8}$ and $2\frac{3}{4}$ sizes are normally divided into two counts for each size in the tray pack. That is 163 and 150 for the $2\frac{5}{8}$ and 138 and 125 for the $2\frac{3}{4}$ apples. In the cell pack all the $2\frac{5}{8}$ apples pack satisfactorily as a 140 count and all $2\frac{3}{4}$ apples pack a 128 count.



The finished Tray Pack cut away to show the trays and position of the fruit.

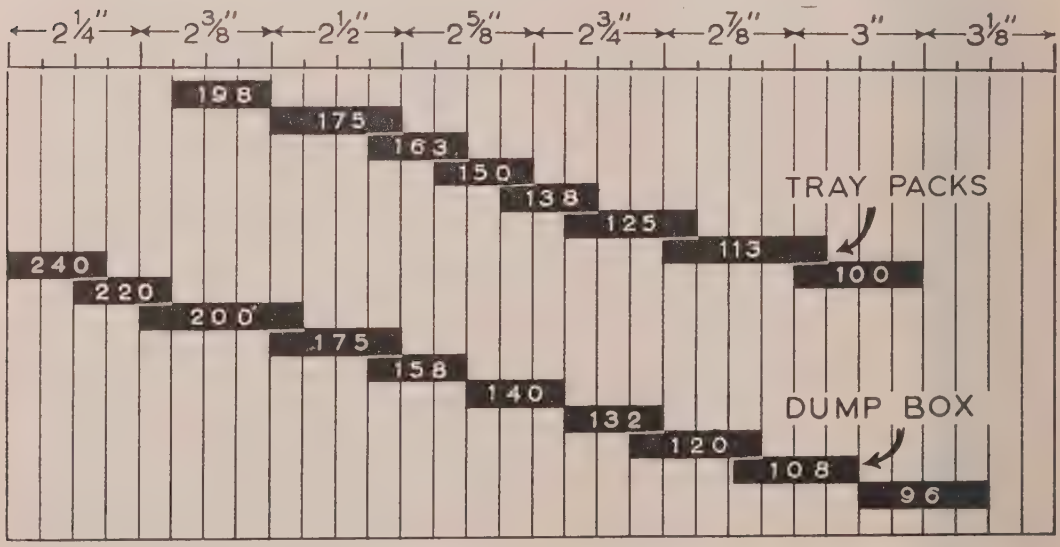


Diagram of size—count relationship of the tray pack carton and the dump box.

It is a decided advantage to split the sizes in a large packing shed so as to provide more space for the packers by spreading the apples over more bins and from this point of view tray packs could prove easier to handle. It is not possible to set up a sizing machine with two bins together having the same size fruit unless a cut-out is fitted to each bin of the machine. A separate sizing machine would facilitate the handling of cell packs.

AUSTRALIAN APPLE BOX

With one exception namely the 2½ Granny Smiths the sizing for the dump box is quite different to that required for carton packs. Therefore, it will be most difficult to pack cartons and wooden boxes from the one machine and wherever possible separate units for cartons should be used.

Overseas reports emphasise the excessive bruising on large sized Granny Smiths. While this is in part due to the susceptibility of large sizes to bruising too often it is due to jamming all the apples in the last bin into the one case regardless of size. Other instances of bruising are also very often related to oversize fruit in the pack.

Without proper sizing changed methods of packing will not necessarily solve the bruising problem. The cell pack has some advantage in this regard in that oversize apples won't fit into the cells.

The size-count relationship between tray pack cartons and the Australian Apple Box is illustrated in the accompanying diagram.

It will be seen that in both the tray pack carton and dump box considerable overlapping of sizes is necessary to obtain the correct count. Cell packs conform exactly to eighth inch sizes.

ACKNOWLEDGMENTS

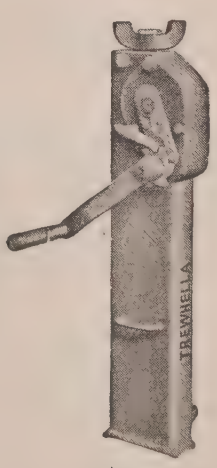
Cell pack cartons and fruit for trial purposes were made available by the Fibre Board Promotion Council whose co-operation in this regard is gratefully acknowledged.

LIFTING JACKS FOR EVERY PURPOSE

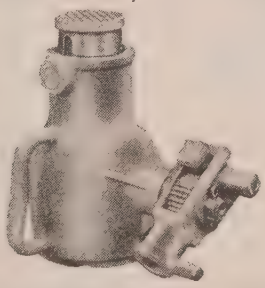
by

TREWHELLA Bros. Pty. Ltd.

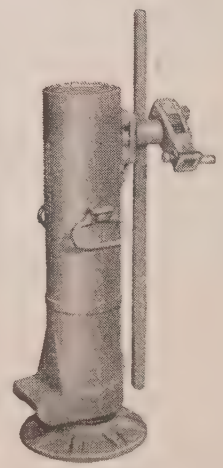
TRENTHAM, VICTORIA



6 Tons Capacity Rack and Pinion Jack.



35 Tons Capacity Ball Bearing Screw Jack (Short Lift), also Other Types and Sizes.



30 Tons Capacity Ball Bearing Screw Jack. 15 inch Rise.

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W82/

Points on

PRODUCING BETTER PIGS

by

P. C. BECK, Field Technician
Dairying Division

THERE are many factors to be considered in the production of quality pigmeat which today is the demand of the housewife. Poor quality means two things, bad advertisement for the industry and low returns to the producer.

It is not sufficient to pay attention to one or two of these factors only. Well-bred pigs can be unprofitable if they are badly fed or inadequately managed. Good feeding and housing cannot overcome all the disadvantages arising from unsuitable breeding stock, and faulty management can nullify most of the advantages gained by careful attention to other factors.

These pigs shown in the slaughter yard have been marketed at the correct stage of development.

BREEDING

Choose your breeding pigs from stock that is not only pure-bred but is backed by records of large healthy litters of pigs which showed good food conversion rates —in other words, pigs which showed the maximum increase in body weight for the poundage of food consumed.

Strong healthy litters such as this should be the aim of every pig raiser.

Do not choose breeding stock with inherited defects such as hernia and blind, inverted or irregularly-spaced teats. Choose sows with 12 or more evenly-spaced teats extending well forward. Do not tolerate any tendency towards weakness in the legs of breeding stock, and make sure that the boar has two evenly-suspended and equal-sized testicles.

Always use a pure-bred boar and maintain him in good condition by feeding him according to the amount of work he is required to do. One boar to 20 sows is the maximum ratio. Hand-mating is preferable to allowing the boar to run with the sows. (Use breeding records and aim at two litters in approximately 13 months.)

FEEDING

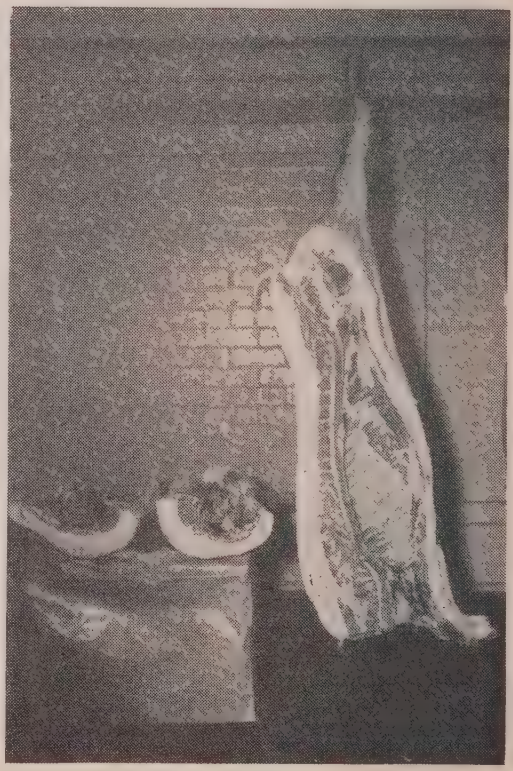
Perhaps the most important single factor governing growth is protein which, in pig-raising, is usually provided by foods of animal origin such as skim milk, meatmeal, whalemeal, etc. Young pigs have the greatest relative need of this material, as it is during the early periods of life that the greatest growth of lean meat and bone is made.

To facilitate this and ensure rapid growth in the young pig, an adequately balanced ration, containing the ideal proportions of protein of an animal origin to carbohydrate material, must be provided by creep-feeding a high protein ration (approx. 18 per cent.), from three weeks of age. This proportion is reduced gradually until market weight, when a higher percentage of carbohydrate to total protein in the ration is required for finishing off with the desirable proportion of fat coverage to lean meat. (See feeding table.)

Minerals and vitamins form an important part of the diet. Where no green feed is available, a vitamin A supplement, especially for in-pig sows, is required. The calcium part of the diet should be made up by providing limestone fines at the rate of 1 lb. per 100 lb. of grain. (When feeding skim milk, the calcium supplement may be deleted from the ration.) Where the salt content of water is above 100 grains per gallon, salt need not be provided; otherwise it should constitute ½ per cent. of the ration, (½ lb. salt per 100 lb. grain.)

Experiments have indicated that the feeding of antibiotics is not warranted except in the case of backward types of pigs which have become unthrifty through sickness. Feeding of antibiotics full-time as part of the ration becomes costly and may not be compensated in the returns.

Where sows and litters are run on concrete, provision should be made, as prevention against anaemia in the young pigs, to allow access to grazing for a short period each day, otherwise, a clod of fresh clean earth from a pig-free area must be placed in the pen to ensure the iron requirements of young pigs. The sows' milk is deficient in this element.



This carcase is grossly overfat and is the type which causes the pig industry the most concern.

When hand-feeding baconers, 6½ lb. of concentrate meal per day should not be exceeded, or if self-feeding, market pigs at slightly lower weights as they fatten earlier on unlimited food. A 100 lb. grain ration could be constituted as follows:—

(1) 50 lb. wheat; 50 lb. barley.

(2) 40 lb. wheat; 40 lb. barley; 20 lb. oats.

(3) 40 lb. wheat; 30 lb. barley; 30 lb. oats.

Oats, because of their high fibre content should not constitute more than 30 per cent. of the total grain ration, except where finishing pigs at heavier weights on

Age and Classification	Approx. Liveweight	Separated Milk	Meatmeal or equivalent (50% protein basis) OR	Carbohydrate food crushed wheat or equivalent	Approx. overall percentage protein in total ration
	lb.	gal.	lb.	lb.	%
3–8 weeks sucker	12–40	creep-self feeder ration			18
8–10 weeks weaner-slip	40–50	¾	½	1–2	18
10–14 weeks grower	50–80	¾	½	2–3	16
14–18 weeks light porker	80–100	¾	½	3–4	15
18–22 weeks heavy porker	110–140	¾	½	4–5	14
22–28 weeks light and medium baconer	140–200	¾	½	5–6	13
Heavy baconer	200 plus	¾	½	6	13
In-pig sows and boars	....	1½–2¼	1–1½	6–9	16
Sows and litters	....	3–4½	2–3	8–12	17–18

self-feeders is practised. Protein supplement of animal origin is added to the grain at varying rates to obtain the desired protein percentage in the ration.

As a guide to hand feeding allow 1 lb. of concentrate meal per 28 lb. liveweight, approximately.

Different breeds of pigs vary in age of maturity. Thus the extent or nature of crossbreeding and the environment in which pigs are fed and raised are the factors which determine the correct time at which to market for prime quality. Do not hold baconers once they begin to show signs of becoming overfat. This is most uneconomical.

Using 100 lb. of crushed grain as the basis of a ration, the approximate overall percentage of protein in the total ration, as shown in the last column of the feeding table, can be achieved as follows, using 50 per cent. protein meatmeal.

18 per cent. protein—15 lb. meatmeal, 100 lb. grain.

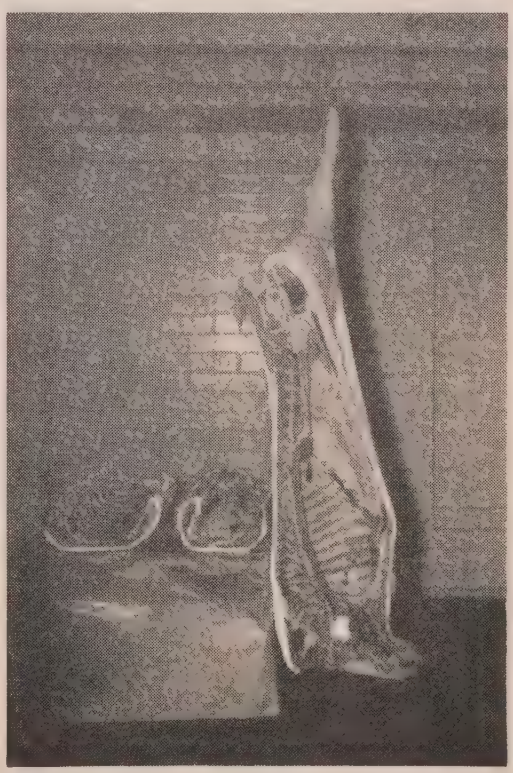
15-16 per cent. protein—10 lb. meatmeal, 100 lb. grain.

13 per cent. protein—5 lb. meatmeal, 100 lb. grain.

Separated milk is the most valuable source of animal protein for pigs and its usage is mainly governed by its availability throughout the various seasons of the year.

In the South-West butterfat-producing areas the flush of skim milk and pasture occur together, and it is possible to replace the cereal ration entirely with skim milk and good mixed pasture.

It is advisable to provide lactating sows with up to approximately 4 lb. per day of crushed grain in addition to the grazing



This carcase is unfinished and has an inadequate balance of fat in relation to the lean meat.

These middles show excellent lean meat development with a good balance of fat.

and skim milk. Weaners and slips should also be provided with a small grain ration for bulk food requirements.

However, as the quality of the pasture deteriorates and the supply of skim milk slackens off, a gradual replacement with a normal cereal meal must be made. Replacement should be made on the basis of 1 lb. of cereal meal being equal to approximately a gallon and a half of skim milk. It is estimated that approximately 6 lb. of good quality mixed pasture is equal to 1 lb. of cereal meal.

HOUSING

The most important feature in housing is hygiene. Clean quarters allow for a maximum in health and growth performance. Dirty, unclean housing retards growth rates and reduces liveability. Pigs in conditions such as these are far more susceptible to disease.

Farrowing facilities are extremely important and can be a deciding factor between good and only marginal profits.

Design of these quarters must be such as to keep piglet mortality at a minimum and to provide a sanctuary for the young pigs to retreat from the risk of crushing or trampling by the sow. Very important indeed is the need for warmth. The farrowing house must be draught and moisture free and the use of radiant heaters in cold weather, even for only three to four days after birth is desirable.

Where pigs are grazed, shelter sheds, preferably portable, for warmth in winter and protection from the sun in summer are essential.

If intensive methods of pig raising are practised, strict hygiene must be carried out. Provision must be made in housing design for coolness during hot weather and warmth in cold weather conditions. Water is an essential nutritional factor, and should be provided in a fresh clean state and be available to pigs at all times.

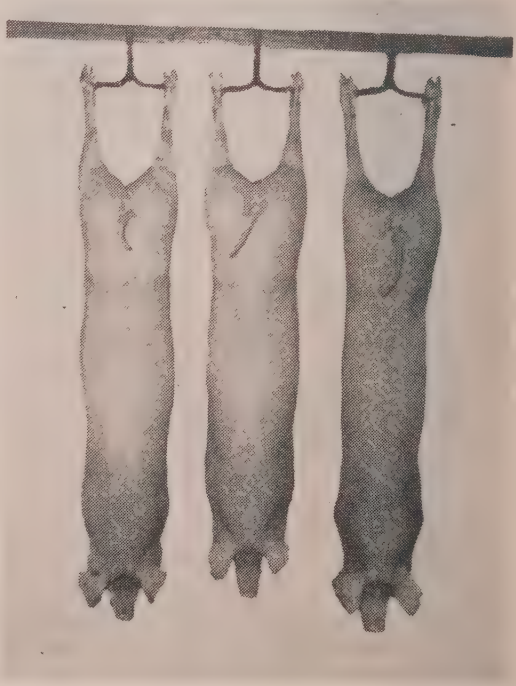
GENERAL MANAGEMENT

Prevention of disease and reduction of worm infestation is most important; use paddocks in rotation and during the resting period cultivate and, if possible, crop the area. This is instrumental in reducing worm infestation and also makes use of the fertiliser value of the manure. Do not allow overstocking, and avoid bare earth yards. They are detrimental to the health of pigs, as disease-causing organisms are harboured in this environment.

Castration of boars should be carried out at three to four weeks of age.

Deworming should be practised initially soon after weaning and periodically thereafter. Care should be taken with deworming powders containing Sodium fluoride as this is a highly toxic compound.

Piperazine-based worm compounds are highly effective and do not cause adverse after-effects.



Carcases such as these would be welcome on any market.

Wherever possible, green pasture of good quality, grazed early to obtain the highest nutritive value, should be provided as a means of reducing the intake of expensive purchased feedstuffs. Green fodders such as lucerne, kale, rape and maize, also mixed clovergrass pastures and young green oats and barley provide very valuable grazing for pigs.

Start pigs on a correctly-balanced ration and keep them growing rapidly up until slaughter. Do not allow a "store" period and market early to avoid over-fatness.

During periods of prolonged low returns do not dispose of all breeding stock, or go completely "out" of pigs, but retain a small nucleus of good breeding animals.

Buying breeding stock at trade sales is a poor policy.

Practise efficient feeding, husbandry and management, use good breeding stock, and pig raising can be a profitable enterprise.

PLANT SPECIMENS FOR IDENTIFICATION

By R. D. ROYCE, B.Sc. (Agric.), Senior Botanist, and N. G. MARCHANT, Herbarium Assistant

PLANT names and the naming of plant specimens are of fundamental importance in the science of botany. In applied botany as well, proper identification is of the utmost importance. In agriculture for instance, accuracy in naming poisonous plants and weeds, as well as fodder and pasture species, can save farmers considerable sums of money, and may be responsible for avoiding heavy stock losses.

The most important requirement for the successful naming of a plant is a good specimen to work with.

THE SPECIMEN

When selecting material for the preparation of a botanical specimen, many factors have to be considered.

In the case of small herbs, the whole plant including roots should be taken, and when collecting those which have only one flower per plant, a number of such plants should be gathered and treated as the one specimen. It is particularly important that small plants which have the leaves concentrated in basal rosettes at ground level, and with erect leafless flowering stems, should be gathered with leaves and stems intact.

Grass speciments should be collected in this manner, so that they show the base of the plant, the roots and the barren stems as well as the flowering stem.

When collecting a specimen from a tree or shrub, it is essential that the piece taken should be truly representative of the plant from which it came.

To be of maximum use a specimen should be at least 9 to 10 in. in length and show the arrangement and attachment of the leaves on the stem, and should carry a number of buds, flowers or fruits.

When only one or two specimens are being prepared, no elaborate precautions are necessary. Individual plants, particularly herbs and other slender species, can be laid out between pages of a book, or into the fold of the daily paper. Pressure can then be applied by placing two or three books or newspapers on top.

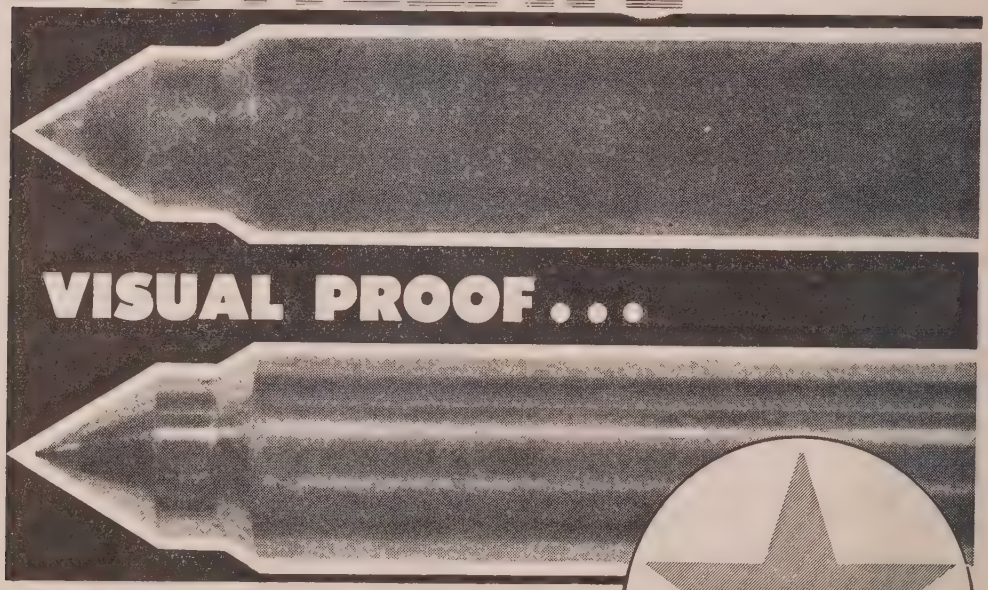
The most useful size of paper for the average specimen is approximately 10 inches by 12 inches, and this is obtained by folding sheets of the daily paper in halves.

All specimens submitted for naming should be clearly numbered for easy recognition. Two pieces of each plant should be tagged with the same number. One is then forwarded to the State Herbarium and the other is retained for reference and comparison with the list of identification when it is received.

The value of these specimens can be greatly increased if a few notes concerning each plant are forwarded with the pressed material.

Lastly it is most important that the name and address of the sender should be placed inside the parcel.

NEW AUSTRALIA'S FIRST DETERGENT ACTION DISTILLATE



Unretouched photographs of injector nozzles clearly show the difference.

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TIME OF LAMBING *Experiment*

MERREDIN RESEARCH STATION, 1959-60

(Progress Report)

by

W. L. McGARRY, Officer-in-Charge
Sheep and Wool Section

and

I. K. STOTT, B.Sc., (Agric.)
Sheep and Wool Adviser

FOLLOWING upon the Time of Lambing Experiments at Esperance Plains Research Station (Journal of Agriculture, May, 1960) it was decided to carry out similar work with Merino sheep under the relatively harsher environment at Merredin Research Station.

INTRODUCTION

It was considered that using Merinos for the experiment under this typical eastern wheatbelt environment would yield information applicable to a wide area of the agricultural areas of W.A. If, under the short season at Merredin, spring born lambs could reach satisfactory weaning weights, maintain these weights over the summer, with comparable wool cuts at their 2nd and 3rd shearing with autumn-born lambs, it could be assumed that the practice of late winter-spring lambing with Merinos was applicable in most parts of the agricultural areas.

Early results are particularly encouraging—especially in relation to the savings made in pre-natal supplementary feeding and the lower incidence of tender wool in the Spring lambing ewes.

EXPERIMENTAL PROCEDURE

The experiment commenced in November, 1959, when the main ewe flock was divided at random into two groups of 130 ewes.

Group 1 (Brown tags) was mated with 1 per cent. "teaser" rams on November 25th. After 14 days the "teasers" were removed and the fertile mating at 3 per cent. commenced. The mating period was 8 weeks.

Pre-natal supplementary feeding commenced on 21/3/60 and continued until lambing commenced on 8th May. The total grain fed to this date was 3,564 lb., or 27.4 lb. per ewe. This could be considered the pre-natal ration. Owing to the inadequate pasture available during May and June, supplementary feeding was necessary and was continued for a further two months (until July 4th) during lambing and lactation. Six thousand eight hundred and sixteen lb. of wheat or 52.4 lb./ewe were fed during this period, making a total for grain fed per ewe of 79.8 lb. Based at 13s. 5d. per bushel, the cost of supplementary feeding/ewe was 17s. 10d. or 22s. 8d. per lamb marked (78 per cent. marking). This does not include cost of labour, feeding out, etc.

The lambs were weaned at 14 weeks from the date lambing commenced. They were weighed at weaning and subsequently on 14/12/60.

Ewes and lambs were shorn at the main shearing in October.

Group 2 (Yellow tags) was mated with 1 per cent. "teaser" rams on February 16th. The "teasers" were removed after 14 days

and the fertile mating at 3 per cent. commenced. Mating was again for 8 weeks.

These ewes were carried through without any supplementary feeding.

The lambs were weaned at 14 weeks from the date lambing commenced on to a paddock of mown and dropped pasture. They were weighed at weaning and subsequently on 14/12/60.

Ewes and lambs were shorn at the main shearing.

Weaners, Groups 1 and 2. On 15/11/60, when Group 1 lambs were 22 weeks old and Group 2 lambs were 14 weeks old, the two groups were allowed to run together.

Supplementary feeding of the weaners commenced at ¼ lb./head/day of wheat on 1/1/61 and was increased to ½ lb./head/day on 15/1/61.

RESULTS

	Group 1	Group 2
	Dec. Mated, Autumn born lambs	March Mated, Spring born lambs
Number of Ewes	130	130
Mating Commenced	11/12/59	1/3/60
Mating Period	8 weeks	8 weeks
Lambing Commencing	8/5/60	30/7/60
Percentage of Lambs Dropped to Ewes Mated	86%	87%
Percentage of Lambs Marked to Ewes Mated	78%	80%
Weaning Weight (at 14 weeks from Date Lambing Commenced)	49·3 lb. 15/8/60	51·7 lb. 7/11/60
Weight at 14/12/60	77·14 lb.	59·52 lb.
Weight at 17/1/61	75·0 lb.	61·2 lb.
Ewe Deaths	4	14
Shorn on	10/10/60	10/10/60
Average Greasy Wool Weight (Ewes)	11·2 lb.	11·9 lb.
Percentage of Tender Fleeces	23·6%	8·8%
Grain Fed (to Ewes)	79·8 lb. (wheat)	*Nil*
Cost at 13/5 bushel	17s. 10d.	*Nil*

DISCUSSION

Contrary to other work, conception rates and lamb marking percentages were similar in each group. It was anticipated that the spring lambing group would have been superior, as March is regarded as a more ideal mating time. Perhaps nutritional flushing at mating would have given greater differences.

Weaning weights at 14 weeks from the date lambing commenced were almost similar. The performance of the weaners is being studied over the summer (body weight and deaths) and the 2 and 4 tooth shearing results are to be considered. One criticism of spring (August) lambing has been the affect on the lambs, before and after weaning, of the season drying off from September onwards—so far this does not appear to have been a factor. (See respective weights 14/12/60 and 17/1/61.)

Perhaps the most significant difference so far between the groups has been in the cost of supplementary feeding—18s. 9½d. per ewe for the autumn lambing group and nil for the spring lambing group.

Another important difference was the ¾ lb./head extra greasy wool cut by the non-fed ewes. The fed ewes were supplemented for 3 months and yet cut less wool.

The ration decided upon for the autumn lambing group could have been too liberal, but the amounts fed pre-natally were those fed normally to autumn lambing ewes on Merredin Research Station and are typical or even low when compared with those fed to many autumn lambing flocks in the agricultural areas. Similarly with rations fed during lactation. Pasture growth was late and slow in May and June in this season, but the amounts fed post-natally were similar to those given either at the Merredin Research Station or on farmers' properties where lambing is timed to take place in autumn. In all, pre-post natal supplementary feeding was necessary for 3 months—this is not unusual in most flocks in the "autumn drought" type environment in the agricultural areas.

CONCLUSIONS

The experiment so far has shown:—

(1) An advantage to the spring lambing group in the saving of the normal pre-post-lambing supplement.

(2) Less tender wool and a higher greasy wool weight in the wool of the spring lambing group.

(3) More ewe deaths in the spring lambing group.

Further investigations will be carried out on:—

(1) Greasy and clean wool weight differences.

(2) Incidence of tender wool.

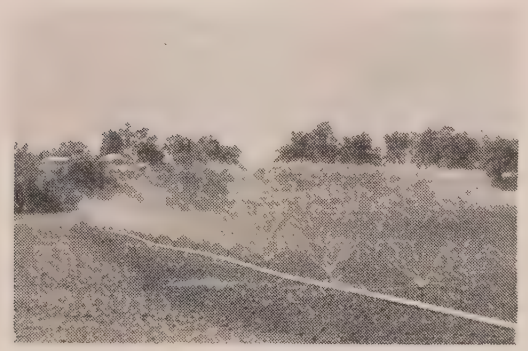
(3) The differences in ewe deaths. (It was considered that at least 11 of the 14 ewes dying in the spring lambing group died from entero toxaemia, despite normal inoculation. Extra inoculations will be given in future trials.)

POTATOES

Sprinkler Irrigated from the COLLIE RIVER

by
J. W. LEWIS, BSc. (Agric.),
Irrigation Adviser

THE highly productive soils of the flats along the Collie River at Roelands are an important source of many of our summer grown potatoes in this State. Large areas are planted year after year, the record being held by Mr. Clarry Cox of Roelands, who has planted potatoes on the same seven acres every season since 1922.



Ground being watered before planting.

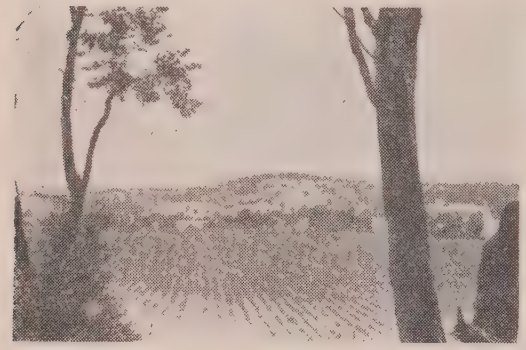
A close up of the planting operation.

About one quarter of the total acreage is irrigated by gravity from the main supply channels which convey water to the irrigation areas, and the remainder is irrigated by pumping from the Collie River. To supply sufficient water for this purpose, water is periodically let down from the diversion dam, which is below Wellington Dam.

Planting being carried out after watering.

Potatoes at the early growth stage.

Over the years, much work has been done on the flats, and they have been considerably improved by grading and drainage. Also most of the river banks have been built up to prevent the river overflowing during the winter and damaging the flats.



A panorama of the flats, looking towards the Collie River.

Before planting, the ground must be well prepared, and a green manure crop of oats is usually grown during the off-season. Many growers broadcast the seed on the potato tops before digging the crop the preceeding autumn, and it is covered during the digging operations. This is a precaution against seasonal conditions, for at the completion of digging, the soil could be too wet for machinery. This crop is ploughed in during November or December. Three ploughings are usually necessary, each one progressively deeper, until a total depth of about 8 in. is reached.

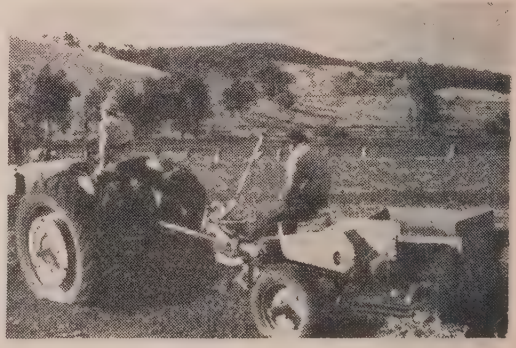
Planting is usually commenced in mid-January, the exact time depending on the season. It may be carried out by hand or machine, and one ton per acre of potato manure is applied at the same time.

A well grown crop.

The first irrigation takes place 1-2 days before planting, to bring the soil to a suitably moist condition. Subsequent irrigations naturally depend on the season, but on an average, four waterings, each of 1-2 inches/acre, are applied during the growing period. Irrigation is essential to ensure good yields, which average 8 tons per acre.

There is a great deal of work to do on the potato crop during the four months it is in the ground. Apart from irrigating, the ground must be cultivated to mound the earth around the roots of the plant. This is done either with a horse or tractor. Insect pests can be a problem too, and potato moth, cutworm, black beetle and aphides must be sprayed, perhaps several times.

Potato plants about one month old being sprinkler irrigated.



Digging with machine in May.

Bagging up the potatoes.

Digging the potatoes by fork or machine is commenced some time in May, and is completed as rapidly as possible before the winter rains set in. All that remains after the bags are sewn and carted are the grading and marketing operations, and finally the potatoes end on the consumer's table. These potatoes keep well and are sometimes not sold until August or September.

A moment's contemplation during the bag-sewing.

SPRINKLER IRRIGATION

By George Gauntlett, B.Sc. (Agric.), Assistant Officer in Charge, Irrigation

In the design of a sprinkler system perhaps the most important feature is the sprinkler itself. The rest of the equipment is to ensure that the sprinkler will perform with maximum efficiency.

The sprinkler is hydraulically designed to control the volume of discharge, the distribution pattern, drop size and its purpose is to supply water to the soil at the required intensity.

It should be robust, dependable, conform to the manufacturer's specifications, ensure an even distribution of water and be reasonably priced.

In any sprinkler the amount of water discharged decreases as the distance from the sprinkler and so it follows that an absolute uniform application is impossible.

This is remedied by overlapping the spray. For calm days this overlap is between 60% and 65% of the wetted diameter. Under windy conditions the overlap must be considerably more. This necessitates a closer spacing of the sprinklers.

A sprinkler must not discharge water faster than the ground will absorb it. For an average loam soil about 0.5 inches per hour can be applied and for sandy soils about 0.7 inches per hour.

Sprinklers are many and varied and the operating pressures range from 5 lbs. per square inch to 100 lbs. per square inch.

To ensure maximum efficiency it should always operate at the pressure stipulated by the designer.

At pressures lower than the stipulation the water is not broken up properly, it remains in larger drops which tend to compact bare soils, the spread is decreased and the distribution pattern is not so uniform.

At higher pressures the water is thrown higher, broken up more finely and more subject to wind action and evaporation losses.

The selection of the right type of sprinkler depends on an analysis of the prevailing conditions.

It should be remembered that doubling the operating pressure will approximately double the fuel consumption or if electric power is used, the power requirements.

In orchards where low branches can interfere with the spray, consideration should be given to the use of the low trajectory sprinkler.

When water of doubtful quality is being used the low trajectory sprinkler will minimise damage to the foliage and only a minimum amount of any spray that has been used is washed off.

Finally, the sprinkler selected should always be used according to the specifications laid down by the manufacturer.

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Chemical Poisoning IN ANIMALS

By H. D. SEDDON, B.V.Sc.

I.—ARSENIC

ARSENIC is poisonous to all animals and to man in quite small amounts and exposure to poisoning is often a result of human carelessness. It is present in many chemical dips used for control of insect parasites on stock, and in agricultural fruit sprays and weed killers whose relative cheapness makes their use economical. However, their potential danger and the economic loss they may cause are a disadvantage.

Poor fencing which allows animals to graze pasture where there is arsenic containing refuse or discarded sheep dip tins are examples of the carelessness which may result in stock losses due to poisoning. Refuse piles, old house or shed sites, unused buildings or the effluent from sheep dips may provide sources of arsenic and cause stock to die suddenly and for no apparent reason.

Sheep dipped in insecticides containing soluble arsenic compounds, may be poisoned by swallowing some of the dipping fluid on plunging in, or by absorption directly through the skin. Absorption by this latter route is much more rapid where fresh skin wounds are present, so that symptoms may occur in sheep lacerated at shearing. However, it is usually where conditions delay drying of dipped sheep that poisoning symptoms tend to appear. This occurs if sheep are dipped when carrying long wool, late in the day, during or just before wet weather, or on yarding close together or in the shade after dipping.

Excessive doses of bluestone arsenic as a drench for the control of internal parasites in sheep may also result in poisoning, especially if carried out a few days after dipping in an arsenical fluid. The arsenic received at drenching is practically all eliminated by the end of one month.

Arsenic is absorbed from the stomach and small intestine where it acts on the lining in a similar manner to a caustic agent. Large doses cause signs of *acute poisoning* with severe irritation of the stomach intestinal walls causing vomiting, abdominal pain and diarrhoea, followed by collapse, coma and death. The liver may become yellow due to the deposition of fat as a result of toxic changes.

Smaller doses produce *sub-acute poisoning* accompanied by milder symptoms with a more prolonged course which may not result in death.

Chronic poisoning results from the ingestion of many small doses of arsenic over a long period of time and death

sometimes results from accumulation of lethal amounts of the poison in the body.

Arsenic is eliminated from the body in the faeces, urine, milk and sweat. However some forms of arsenic are excreted only slowly and tend to accumulate in the liver, so that successive treatments or accidental ingestion can result in the accumulation of toxic amounts in the animal's body. From the liver, it is slowly distributed to the soft tissues and later on is stored and fixed in the bones, skin, hoofs and hair. It cannot be absorbed back into the body from these sites, and is therefore no longer a source of poison to the animal.

The average dose of arsenic necessary to produce death varies with the weight and age of the animal and the form and solubility of the arsenic compound.

Symptoms.

In very heavily poisoned animals, symptoms may not be observed prior to death and they may die within an hour of swallowing the arsenic.

Acutely poisoned animals show a sudden onset of symptoms and one or more of them are often found dead. Salivation thirst and a blackish, watery diarrhoea— often blood stained— are present, leading to exhaustion and death. Affected animals become weak in the hind-quarters, stagger and often collapse and are unable to rise. They show muscle tremors and stiffness in the hind limbs and the pulse is feeble and weak. Intense abdominal pain is accompanied by groaning, grinding of the teeth and looking at the flank, with a depressed appetite and milk yield. Acutely poisoned animals often die, even when treatment is given.

Sub-acutely poisoned animals show less marked symptoms, and may live for several days. They are off feed and depressed, with a weak and staggering gait. They show apparent paralysis of the hind quarters, muscle tremors and perhaps convulsions. The urine may be blood stained.

A scald due to arsenic may be seen in sheep and pigs where arsenical preparations have been applied to wet skin or to open wounds. The skin shows a scaly appearance with cracking of the skin which becomes inflamed.

Animals which have been chronically poisoned over a long period of time show few symptoms apart from a general unthrifty appearance. There may be indigestion, thirst, a dry staring coat and brick red discoloration of the lining of the mouth.

On post-mortem, the most characteristic lesions are a rose-red inflammation and blood spots on the alimentary tract, particularly the stomach. The intestinal wall appears swollen and the surface comes away when gently rubbed. There may also be small haemorrhages in the liver, kidneys, heart and lungs. The stomach wall may bleed and ulcerate, and these ulcers may rupture, releasing intestinal contents into the abdominal cavity, resulting in peritonitis and death.

In *cattle and sheep,* inflammation of the abomasum (fourth stomach) is usually pronounced, although in cases where only small amounts of arsenic have been taken, these changes may not be noticeable. The liver may be yellowish due to toxic changes, and the spleen soft. The lining of the mouth is usually swollen and brick-red in colour. Ulcers with deep red bases may be seen on the articulating surfaces of the joints. These occur mostly in the hind limbs and are responsible for a stiff gait and reluctance to move.

In *pigs* the inflammation of the mouth with weeping of fluid may be severe and extend to the lining of the windpipe, resulting in death by suffocation. Inflammation of the stomach wall is also seen.

In *fowls* there is intense inflammation of the gizzard whose horny lining may become separated from its muscular layers. There may also be slight reddening of the lining of the crop and the first loop of the small intestine. The liver is paler than normal.

Treatment.

Treatment should be started immediately signs are noticed by moving either the animal or the source of arsenic. In dogs, an attempt should be made to make the animal vomit by giving a strong solution of salt and water. All animals should be given a strong purge to remove the unabsorbed material from the bowel, followed by the feeding of liberal amounts of paraffin oil, egg or milk to prevent

further absorption and protect the lining of the stomach. Drenching with Epsom salts or Glauber's salts dissolved in water will produce purging, a dose of ½ to 1 pound being used with adult cattle or ½ pound with horses, sheep, goats and pigs. These doses should be reduced for young animals and those in poor condition.

In sub-acute cases drenching with sodium thiosulphate (Photographer's "Hypo") within a few hours of the ingestion of arsenic may be successful in saving the animal. A better chance of recovery can be expected where mild symptoms are shown. A dose of 1 to 2 ounces to be dissolved in a half pint of water is advised for horses and cattle, while one ounce is sufficient for adult sheep and goats. These doses should be repeated in 4 to 6 hours if signs reappear. Veterinary assistance should be sought wherever possible.

Animals should be kept quiet and given unlimited water, but no feed for 48 hours. After that period, feed incorporating plenty of good quality hay should be given. However, treatment of acute poisoning is usually unsuccessful as some time has generally elapsed before arsenical poisoning is suspected.

Animals which do recover will show some return of appetite within three days of eating the poison and the diarrhoea will cease in the following week with gradual return to normal health. This may be associated with loss of hair and reduction or termination of lactation in milking cows.

Prevention.

This is essential where arsenical compounds are being used in agricultural control programmes of insects attacking plants or drenching for worms in animals and is largely a matter of care and common sense. Tins which contain or have contained arsenical compounds should be removed from places where animals can gain access to them. Dipping fluids should be disposed of in a safe place, as sheep and cattle often develop a taste for arsenic compounds and will selectively graze contaminated pasture. For this same reason, cattle should not be allowed to graze on patches of weeds which have recently been sprayed with an arsenical weedicide.

Arsenic compounds should be kept out of reach of children at all times.

AUTUMN PREPARATION FOR VEGETABLES

Once again growers are preparing for the autumn, and although much of the plantings have already been carried out, this is a good time to plan for the cool period ahead. The autumn is actually a very good time for vegetable growers, as conditions for the growth of crops are generally excellent.

In the garden, the autumn temperatures are almost ideal for carrying out eelworm control by the use of either shell D.D. or Ethylene-di-Bromide or E.D.B., as it is commonly called. Soil treatment is not highly effective if the soil is either too warm or too cold. For this reason the autumn and spring are the best times to carry out control measures.

Recently many growers have adopted fumigation practices using methyl bromide. This is a highly poisonous gas and great care must be adopted when it is being used. As bean and tomato crops die off, it is suggested that growers fumigate the sticks before putting them away, or else treat them in a formalin dip. Growers using methyl bromide report that they can carry out such routine tasks more easily and that good results are obtained. The fumigation of seed beds has now become regular practice at the Vegetable Research Station, and by this treatment all diseases and pests are readily destroyed. Since seed bed care is of great importance in the production of healthy plants for planting out, the adoption of this practice is suggested to growers as being very worthwhile.

Growers might also consider the planting of a green manure crop within the next few weeks. On local sandy soils the growing of such crops is most useful, and the easiest way in which to return organic material to the soil. As growers tend to rest some of their ground during this time a good way to add an inexpensive improvement is by the use of green manure.

(From a talk given by D. A. Johnston, B.A., B.Sc. (Agric.) and printed with permission of the A.B.C.)

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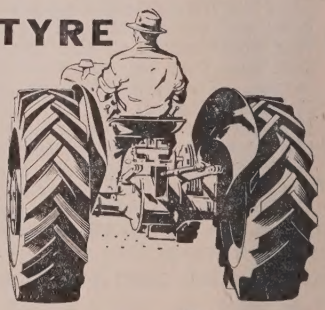

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